Anno 1778.

PHILLIPS·ACADEMY

OLIVER·WENDELL·HOLMES

LIBRARY

Per ampliora ad altiora.

el
2.80+

CHIMPANZEE INTELLIGENCE AND ITS VOCAL EXPRESSIONS

Digitized by the Internet Archive
in 2019 with funding from
Kahle/Austin Foundation

https://archive.org/details/chimpanzeeintell0000yerk

CHIM

CHIMPANZEE INTELLIGENCE AND ITS VOCAL EXPRESSIONS

BY
ROBERT M. YERKES
AND
BLANCHE W. LEARNED

BALTIMORE
THE WILLIAMS & WILKINS COMPANY
1925

23490

L

COPYRIGHT, 1925
THE WILLIAMS & WILKINS COMPANY

Made in the United States of America

Published April, 1925

599.8
Y4c

COMPOSED AND PRINTED AT THE
WAVERLY PRESS
FOR
THE WILLIAMS & WILKINS COMPANY
BALTIMORE, MD., U. S. A.

PREFACE

This contribution to our knowledge of the traits and vocal expressions of the young chimpanzee is presented humbly as the first chapter in a continued story. The division of responsibility between the authors is clear. The one, a psychologist, is intent on the description of important traits and the analysis of ideational behavior in chimpanzees and other primates. The other, a musician, has carefully attended to the vocalizations of the chimpanzee and has given a truthful and vivid account of vocal expressions under different circumstances.

The facts recorded in this volume should be useful to musicians, linguists, and psychologists.

THE AUTHORS

June, 1924

TABLE OF CONTENTS

I. TRAITS OF YOUNG CHIMPANZEES

BY ROBERT M. YERKES

CHAPTER I

PAGE

PROVISION FOR COMPARATIVE STUDY OF THE PRIMATES 11

CHAPTER II

HISTORY AND CARE OF A PAIR OF CHIMPANZEES 15

CHAPTER III

PHYSICAL TRAITS 20

CHAPTER IV

MENTAL TRAITS 26
Daily routine 26
Temperament 29
Nest building 36

CHAPTER V

EVIDENCES OF INSIGHT 38
Observational ability 38
Adaptability 39
Insight and ideation 41

CHAPTER VI

SOUNDS AND SPEECH 53

II. VOICE AND "LANGUAGE" OF YOUNG CHIMPANZEES

BY BLANCHE W. LEARNED

CHAPTER I

Introductory Remarks 59

CHAPTER II

Sounds Associated with Food 61
Waiting for food 61
Eating 78

CHAPTER III

Sounds Associated with Other Creatures 103
Behavior with people 103
Behavior together 122

CHAPTER IV

Observation of Adults at the New York Zoölogical Park 144

CHAPTER V

List of Words or Elements of Speech 154

List of References 157

I

TRAITS OF YOUNG CHIMPANZEES

BY

ROBERT M. YERKES

CHAPTER I[1]

Provision for Comparative Study of the Primates

The desirability of adequate provision for the systematic study of all aspects of the lives of the principal classes of primates has long been recognized and the scientists of several nations have at various times made efforts to command resources. Thus far these efforts have been either disappointing or only temporarily fruitful.

Aside from hunting and collecting expeditions which have provided specimens for museums and for morphological research, a few attempts have been made to establish special research stations or colonies for the breeding of the infrahuman primates. Notable among these attempts are the following.

In 1912 German biologists under the leadership of Profs. Max Rothmann and W. Waldeyer established at Orotava, Teneriffe, Canary Islands, a station for the study of the anthropoid apes. It was abandoned in 1923 because of failure of support. In the meantime important studies of chimpanzees had been made, first by Dr. E. Teuber and later by his successor as resident investigator at the station, Dr. W. Koehler.[2]

Dr. G. V. Hamilton (5) for some years maintained at Montecito, California, with the coöperation of the McCormick family, a collection of primates which included several

[1] For efficient assistance in caring for the animals I make grateful acknowledgment to Miss Louise Mumpoting and Miss Geraldine Stowell. The latter assisted also with the speech experiments.

[2] For all references utilized in this book, see list of references at end.

varieties of monkey, baboons, and one young orang-utan. These animals were observed both in their semi-wild and free condition and in various experimental situations arranged in the investigator's laboratory. The work terminated and the station was discontinued with Dr. Hamilton's removal from California in 1917.

Prior to the war, certain groups of medical investigators planned the establishment of a breeding station and special laboratories for medical research on the west coast of Africa or an adjacent island. The development of the project was delayed. In 1922 the Pasteur Institute, under the direction of Dr. A. Calmette, founded a primate station primarily for medical research at Kindia, French Guinea.

At Havana, Cuba, for more than a decade Madame Rosalía Abreu has kept on her estate a collection of monkeys and anthropoid apes. At present she has some 75 animals, including several types of monkey, baboons, mandrills, gibbons, orang-utans, and chimpanzees. Thus far, apart from certain anthropological observations (10) and the studies of daily life made by Madame Abreu, these animals have not been utilized for scientific purposes. The writer has been able during the summer of 1924, by the generous invitation of Madame Abreu, with the support of the Carnegie Institution of Washington and the coöperation of assistants, to initiate certain studies of the behavior, mental life and structural characteristics of animals in this unique collection.

Aside from the scattering specimens of anthropoid ape found in zoölogical parks, there are several in the possession of persons who are both able and eager to advance our knowledge of the primates. Notable contribution to information concerning the characteristics of the mountain gorilla, G. beringeri, which occurs in the Lake Khivu region

of the Belgian Congo has been made by Mr. Carl Akeley. Miss Alyse Cunningham (3) of London has gathered valuable data on the characteristics of the young gorilla, three specimens of which she has kept successfully over varying periods. In addition to gaining unique insight into the daily life of the young of this anthropoid ape, she has demonstrated the possibility of keeping the animals in perfect health and rearing them in temperate climates.

This brief and incomplete historical summary of what has been done and is being undertaken or projected for increase of our knowledge of the primates is offered for the encouragement of those scientists who have come to think of the anthropoid apes as practically unavailable for research. For many years the writer has been deeply interested in the utilization of primate material for the solution of certain psycho-biological problems. During this time he has worked diligently for the establishment of a primate station which should provide for the all-around study—anthropological, physiological, psychological, sociological—of infrahuman primates, and more particularly of the anthropoid apes. There is at least reasonable possibility that such a station may be established in Cuba. Meantime various investigations are being prosecuted, and there is far more reason for encouragement and augmentation of effort than ever before.

This report is primarily an account of observations which, like most of our studies of the infrahuman primates, are preliminary and preparatory to effective and determined attack on important problems. One of the tragedies of our scientific situation with reference to primate material is that few observers succeed in getting beyond the preliminaries of general acquaintance with the animals. Not until a permanent breeding and observation station for such work exists

will this waste of scientific effort be obviated and the systematic and profitable investigation of problems by the use of primates made possible. For those who are familiar at first hand with anthropological and psychological research, it is needless to insist that the infrahuman primates should prove invaluable. With them it should be possible to make observations under controlled experimental conditions and with knowledge of the life history and characteristics of the subject which is either quite impossible or obviously impracticable in case of human subjects. For the layman and would-be patron of research with the primates, demonstration of values is essential.

CHAPTER II

History and Care of a Pair of Chimpanzees

In the summer of 1923, Dr. William T. Hornaday of the New York Zoölogical Park kindly brought to the attention of the writer the availability of a pair of young chimpanzees which appeared to be in unusually good condition and otherwise peculiarly suitable for scientific use. At the time the animals were being cared for at the Park. Subsequently the pair was purchased by the writer from their owner, Mr. Noel E. Lewis, who had recently brought them to the United States by way of England. The animals had been christened Prince and Mary by Mr. Lewis. Prince, he stated to have been captured near Lubutu on the eastern border of the Belgian Congo. He was said to be an unusual type of "blackface" chimpanzee about fourteen months old (August, 1923) weighing 19 pounds, approximately 2 feet 3 inches standing height. Mary, Mr. Lewis reported as captured in British West Africa up the Bonny River beyond Old Calabar. He described her as a "whiteface" chimpanzee with broad head, large, protruding hairless ears, aged about sixteen months (August, 1923) weighing 18 pounds, and 2 feet 1 inch standing height. The male, Mr. Lewis said he purchased on shipboard at an English port. The female, he secured in Africa.

The animals were brought from New York by Mr. Lewis and delivered to the writer at Concord, New Hampshire, August 6, 1923. Then they were taken to Franklin, where until late in September they were kept comfortably and to their evident satisfaction on a New Hampshire farm.

Conditions for keeping and observing the chimpanzees at the writer's country place were very nearly ideal and for eight weeks work progressed steadily and satisfactorily. The animals were housed in well ventilated, commodious quarters and in favorable weather were given their freedom for some hours each day in an adjoining pasture and birch lot.

On September 25 it was necessary to transfer them to Washington, D. C., the winter location of the writer. There they were necessarily housed more closely, suitable cage being constructed in dwelling house with adjoining open-air porch, to which the animals at their desire gained access at any hour of the day. The indoor cage, measuring approximately 10 feet long, 8 feet wide, and 6 feet high, was equipped with toilet, sleeping boxes, climbing ropes.

The room temperature, maintained by a hot-water heater, varied during the winter of 1923-1924 from 50° to 70°F; 60° was the temperature striven for. There was no indication whatever that a higher temperature, such for example as ordinarily is maintained for anthropoid apes in zoölogical gardens, is necessary or desirable for the young chimpanzee. The animals spent much of their time on the open porch or running back and forth between cage and porch. The male even played in the snow, paying little attention it seemed to the temperature, but fascinated by the unusual appearance and feel of the substance. Only once during the period covered by this report (August, 1923 to June, 1924) did either of the animals show symptoms of coryza, and in that instance they simultaneously developed an affection quite evidently contracted from attendant, with sneezing, running of nose, etc. This affection was mild and lasted not more than two or three days. Recovery was complete as well as speedy. My

Chim and Panzee with Mr. Lewis

observations, I believe, justify the inference that young chimpanzees may be satisfactorily kept in temperate climates at ordinary temperatures, if shelter boxes or nests are provided for their protection from inclement or unusually cold weather. They require fresh air, sunlight, clean quarters, suitable food in adequate quantity, opportunity for exercise, and companionship. No highly organized animal, and least of all the anthropoid apes, can be satisfactorily kept in isolation.

I secured Chim and Panzee, for thus they were rechristened, as scientific subjects, with the purpose of rearing them under continuous observation and of becoming thoroughly familiar with their daily life, needs, and their physical and mental characteristics.

This is the first chapter of a story whose length is indeterminate. It is published at this time because of a radical change in plans necessitated by the transfer of work from Washington, D. C., to Havana, Cuba. A second reason for reporting at once the observations of the first few months is the untimely death of Panzee. Although the animals both seemed to be in excellent condition when I purchased them, I shortly thereafter discovered that Panzee was suffering from some puzzling disorder which affected her appetite and activity. So long as she was kept in New Hampshire her condition improved steadily although slowly. We were therefore hopeful of restoring her to perfect health. In the somewhat less favorable climate of Washington and with the closer confinement she gradually lost ground, and on January 19 she died at Havana, whither I had taken her with the hope that the milder climate might restore her. Autopsy indicated that death was due to tuberculosis affecting primarily the abdominal organs. Chim was in perfect health and

physique when he came to me and has so continued. Although he had every possible opportunity to contract tuberculosis he seemingly escaped. At any rate his physical condition appears to be excellent. He is extremely active and to the tuberculin test (intra-cutaneous) his reaction is completely negative.[1]

In addition to observing the varied behavior and environmental relations of the animals in order to familiarize myself with their characteristics, it was arranged to give special and systematic attention to evidences of insight in their adaptive responses, to innate reactive equipment, and to vocal expressions. Considerable progress has been made in each of these several directions.

Since this report is merely a chapter from the life history of a pair of young chimpanzees, it is scarcely appropriate to offer a historical summary of studies of chimpanzee behavior. Such a summary is in course of preparation, but it may more properly find place elsewhere than here. I may mention certain conspicuously important contributions to our knowledge of chimpanzee behavior. Most notable of all are the reports of investigations at the Canary Island anthropoid station. In the bibliography which concludes this report will be found several publications from and about that station. Of peculiar interest and value is the monograph by Koehler entitled "Intelligenzprüfungen an Menschenaffen."

It is pertinent to remark that Koehler (now Professor of Psychology in the University of Berlin) and the writer, in touch since 1914, have been able to assist one another

[1] For administration of this test I desire to make grateful acknowledgment to Major A. P. Hitchens, Medical Corps, United States Army, and Captain R. A. Kelser, Veterinary Corps, United States Army.

materially. They were simultaneously engaged in studies of insight of anthropoid apes, Koehler using chimpanzees at the Canary Island Station, the writer observing an orang-utan at the private laboratory of G. V. Hamilton in California. In the present investigation the writer has been able to profit by the report of Koehler and he herewith gladly acknowledges his obligations to that able and single-minded investigator.

CHAPTER III

Physical Traits

Inasmuch as the subjects of this study cannot be satisfactorily described by special designation, it is evidently desirable to offer brief description of their physical characteristics. This will be attempted for each in turn.

Chim is said by all of the authorities who have seen him to be either a sport or a representative of a type of chimpanzee rarely seen in this country. I infer from available information that he belongs to *Pan schweinfurthi marungensis*. He is covered with a thick coat of rather fine black hair. A few white hairs appear about his lips. The hair is abundant on the head, covering the orbital ridges, and as whiskers along the sides of the face and jaws. His ears carry also a fringe of black hair. The hair on the head is directed backward with no sign of part. At the base of the spine there is a spot which is practically devoid of hair. Below this is a short anal tuft of black hair. The hair on the limbs is abundant and characteristically directed.

His head is round, the face short and abrupt, the hands, feet and limbs proportionately large and extraordinarily well developed, the skin black or very dark brown, the eyes inconspicuous because almost the color of the skin and therefore lacking in expressiveness. They are rather beady, and although indicating keenness and alertness have almost no value as indicators of emotion! His nose is unusually prominent for a chimpanzee and suggests that of the gorilla. The ears are small and set close to the head.

Chim's teeth when I received him were almost black. Mr.

Lewis stated that they were stained by coffee. I surmise, however, that this was not the case and infer from information gleaned from other sources that they had been stained by some African berry or fruit. In the course of the past eight months they have become appreciably lighter and the permanent teeth are now almost white. In August, 1923, and the same is true at the present writing, June, 1924, Chim possessed his full quota of milk teeth, twenty, and in addition his first pre-molars, making a total of twenty-four.

As to the age of this male chimpanzee it may be remarked that fourteen months in August, 1923, Mr. Lewis' statement, is probably an underestimate. It is not likely that the animal would exhibit permanent teeth before the end of the third year. I therefore hazard the guess that he is now (June, 1924) more than three years of age.

The accompanying table (see page 22) presents several physical measurements for each of the animals made on December 19, 1923. The same measures were repeated for Chim on March 25, 1924. Some fifty additional measurements were recorded for future reference.

It may be said in passing that the making of reliable anthropometric observations on chimpanzees is not perfectly simple and easy. In the first place it requires considerable time and patience to accustom the animals to the instruments, and thereafter to acquire such skill in their use that reasonably trustworthy observations can be made.

The characters measured and the procedure employed are described for human subjects by Hrdlička (8). The measuring devices consisted of Hrdlička head calipers, small and large straight calipers, Starrett steel tape, graduated in millimeters, scale, and home-made stadiometer. The latter was constructed with sliding foot-piece so that the animal could

be placed on its back with head against head-rest, legs stretched, and feet against foot-piece. When sitting height was desired the animal was seated upright on head-piece and foot-rest was brought in contact with head.

Certain physiological observations also were made, chiefly because of the unsatisfactory condition of Panzee. It was

Physical measurements

	CHIM		PANZEE
	December 19, 1923	March 25, 1924	December 19, 1923
Weight (before breakfast), pounds	22.6	24.5	18.5
Standing height (taken with animal lying full length on stadiometer), cm	76.0	79.0	70.0
Sitting height, cm	48.0	50.0	44.2
Arm reach, cm	104.0	108.5	99.0
Head length, cm	11.8	12.0	12.6
Head width, cm	10.0	10.3	10.6
Ear (R) length, cm	5.6	5.5	6.5
Ear (R) width, cm	3.6	3.8	5.0

discovered that the body temperature (rectal) of Chim ranged normally from about 36° to 37.5°C. The diurnal variation was surprisingly great. Panzee's temperature ran somewhat higher, ranging commonly from 37.5° to 39°C. At certain times her temperature was obviously subnormal. Whether or not the usual temperature was above normal for her species, age, and sex, I do not know.

Panzee in appearance contrasted markedly with Chim.

She was a typical "whiteface" specimen, presumably *Pan chimpanse* (Meyer). Her coat was black, but notably coarser and more sparse than that of Chim. The hair was less abundant and extended less far forward on the head than in his case. Panzee's orbital ridges carried only a few hairs, whereas his are thickly covered. Her ears also were entirely hairless and unlike his were large and conspicuous because standing out markedly from the head. At the base of her spine there was a semi-circular tuft of white hair 2 to 3 inches in length, thus contrasted with the small black anal tuft in the male. Nothing peculiar was observed in the limb and trunk pelage of the female. The sides of Panzee's face, like Chim's, were covered with hair, but more thinly, so that her white skin showed conspicuously. On her lips and chin the hairs were sparse, short and entirely white.

Panzee's eyes were light brown, large, surrounded by a considerable area of white sclera and extremely expressive. Whereas his eyes are rendered inconspicuous by the lack of contrast with his skin, hers were emphasized because her skin was almost white and her eyes a beautiful brown.

Panzee's head was larger than Chim's, decidedly broader, but with receding forehead and with a much more prolonged face. Her body was smaller. The most conspicuous differences in physique, apart from skin color, were in the characteristics of face and head. Hers was a typical chimpanzee facial angle and expression; his that of the *Kooloo kamba* as described by Du Chaillu.

The lips of Panzee differed in appearance as well as use from those of Chim. Her upper lip was strong and conspicuous. Her lower lip was still more pronounced, protruding ordinarily beyond the upper lip and being used habitually to hold food while she was eating. Chim's lips, in addition to being

much less conspicuous, are used differently in that the lower one is seldom made a temporary repository of food.

Whereas Panzee in both facial appearance and manner suggested the Irish type, Chim similarly suggested the Negro.

Panzee's hands and feet were smaller and more delicate than those of Chim, and she was considerably less fleshy and less well developed than he when the animals were received. Whereas he was conspicuously well developed as to chest, limbs, etc., and extraordinarily strong and energetic, she was thin, weakly, and inclined to quiescence. It was at first supposed that temperamental differences rather than physical condition were responsible for the contrasting behavior of the animals.

Panzee in August, 1923, possessed the regulation quota of twenty milk teeth. With the exception of a broken incisor in the upper jaw the teeth were in fair condition, and were white as compared with Chim's. Possibly her bad physical condition had retarded dental development. In favor of Mr. Lewis' estimate that her age was slightly greater than that of Chim are the cranial measurements and the fact that she was master of the cage when she chose to assert herself. I am inclined to believe that her age also was somewhat underestimated by Mr. Lewis and that when received by me in August, 1923, she was at least three years of age.

Because of the obvious ill health of Panzee, continuous effort was made to discover the nature of her complaint and to improve her condition by out-door life, exercise and careful feeding.

In October, 1923, examination indicated that both animals

were infected with hookworm.[1] They were given on November 1, 3 cc. of carbon tetrachloride by stomach tube, which was followed by 1 ounce of magnesium sulfate in water.

In view of subsequent developments there is no reason to suppose that the hookworms importantly influenced Panzee's condition. All of her symptoms indicated digestive disorder. Her appetite was poor, extremely variable, and the condition of her bowels bad, tending toward diarrhea. Much of the time she preferred to lie in her nest and it was seldom possible to experiment with her. Because of the nature of the symptoms and the writer's inexperience tuberculosis was not suspected until too late. Meantime all resources were exhausted in efforts to discover the nature of the digestive disorder.

[1] I am indebted to Drs. G. W. McCoy and C. W. Stiles of the Hygienic Laboratory for examination and advice, and to Drs. Morris C. Hall and Jacob E. Shillinger of the Bureau of Animal Industry, for treatment of the animals and valuable advice.

CHAPTER IV

Mental Traits

DAILY ROUTINE

The care of the animals would have been simple enough except for the illness of Panzee. They were fed regularly three times a day, the mid-day meal being light, and their dietary was varied. Meats and eggs they consistently refused, but they more or less willingly and eagerly accepted oatmeal, corn meal, rice and hominy boiled and served warm with milk; vegetables—especially carrots, lettuce and, in Panzee's case, tomatoes; berries as represented by blackberries and raspberries; fruits, more particularly apples, oranges, bananas, peaches and pears. Fruits were preferred to all other foods. Cereals were used largely because of availability and convenience. Coarse bread, including corn, whole wheat, and bran, were taken occasionally but not eagerly.

They were extremely partial to milk, slightly warmed, and each was given about a pint a day during the first few months. Either Klim (milk powder) or pasteurized milk were used. Chim takes water in considerable quantity, whereas Panzee usually refused it except when warm. Usually in the middle of the day each animal was given a cup of weak tea and in addition Chim often had about a half-pint of water.

The animals were readily taught to sit at a table especially designed for them and to feed themselves. They could handle cups successfully and use spoons. Chim has consistently refused to dip the spoon into the food, although once

it is filled he will carry it to his mouth. There appears to be a peculiar inhibition in this case. Panzee on the contrary fed herself with spoon readily and skilfully, although she mostly preferred to be fed.

Exceptions to the above statement are due chiefly to Panzee's poor health or to occasional over-feeding. Chim's appetite seems insatiable. He will not refuse any food which he likes so long as he can hold it. Similarly he will drink milk or even water to the limit of his capacity. It is amusing indeed to see him drink directly from a faucet which furnishes an endless supply. He appears to feel under compulsion to imbibe all that comes!

Cod liver oil was given occasionally, especially to Panzee. Chim at no time required medication or tonic for the improvement of his health.

The usual feeding hours were 8.30 to 9 a.m., 12 to 1 p.m., and 5.30 to 6.30 p.m. Immediately after the evening meal, which commonly was a fairly heavy one, the animals of their own accord went to their bed or beds—for some time they were kept separate—and settled themselves for the night. Nothing ordinarily was heard from them until the breakfast hour and often they would be found in bed at that time. Throughout the day, however, Chim kept extremely busy with whatever forms of amusement he could command. Panzee's activity varied notably with her physical condition. Usually she spent several hours of each day resting quietly in bed or lying in a comfortable corner of the living room. During the latter part of her sojourn in New Hampshire she was sometimes fairly active, occasionally playing spontaneously with Chim and even climbing trees when in the open pasture.

It was Panzee's habit to cover herself with hay, blanket or

anything else provided for the purpose. This evidently was partly for warmth, but, as indicated by the use also of any strip of burlap, strings or ropes which happened to be handy, it was in a measure adornment. Chim, on the contrary, gave little attention to articles which might be used to cover or drape about his person. When in bed he apparently preferred not to be covered, and when out of bed he was far too active to keep anything on his person.

Apart from certain exceptional conditions, both chimpanzees were cleanly in their habits. In the quarters provided for them in Washington, D. C.,[1] a simple toilet arrangement was installed, consisting of a galvanized iron pan about 3 inches deep by 15 by 18 inches. This pan was placed on the floor of the cage in one corner and held by wooden cleats which prevented the animal from displacing it. From the side of the cage it could be withdrawn by the attendant to be emptied and washed. Extending diagonally across this pan from one corner of the surrounding frame to another was a strip of wood 2 inches wide by 1 inch thick, on which the animal could stand. Chim evidently understood the purpose of this toilet device from the first. He used it commonly, although not regularly. "Out of sight, out of mind" perhaps accounts for his lapses. Panzee was less reliable, but she also seemed to understand our intent in installing the toilet. Altogether the device worked fairly well, and we experienced no unreasonable difficulties in keeping the quarters tidy.

The nest or bed arrangement consisted of a wooden box 14 inches deep by 32 by 18 and ½ inches (inside), in the

[1] For valuable aid in designing and constructing the quarters I am indebted to Messrs. Blackburne, Lanham, and Hilt of the Zoölogical Park, Washington, D. C.

bottom of which fitted snugly two galvanized iron pans, which were of the same dimensions as the toilet pan. These could readily be removed to be emptied and cleansed. Covering the pans, and also removable, was a piece of heavy wire netting, 1 inch mesh, and on this in turn was placed a burlap bag containing coarse shavings or excelsior. This served as a mattress. The bed was made up each evening and in the morning the mattress was taken out to be dried in the sunlight and the screen and pans removed and cleaned. Undoubtedly a hammock would have served quite as well as the mattress. The latter was used chiefly to assure sufficient warmth to Panzee. She was very partial to a woolen blanket and when given a small white blanket she would take particular pains not only to cover herself neatly and effectively, but to keep it clean. Almost certainly her great care in this respect was due to training before she came into my hands.

In sex behavior and cleanliness my chimpanzees differed markedly from those observed in the Canary Island Station. The latter, because of long periods of confinement in small cages, were filthy in their habits, whereas my animals were tidy. On the other hand, Chim, when received by me, had the habit of masturbating, whereas the reports of the Canary Island observers indicate the absence of this habit in their animals.

TEMPERAMENT

I purchased Chim and Panzee with the information that they differed extremely in temperament. This proved to be true, but whether the significant differences in behavior which are in point may be attributed to race, sex, age, or health differences is uncertain. My conviction, after months

of careful observation, is that expressions of temperament in Panzee were dependent on her physical condition. I do not believe such differences in chimpanzee behavior as are described below can be safely attributed to race, sex, or age. Although we have been slow to admit the fact, it is clear that temperament and character are quite as dependent upon physical constitution as is intelligence.

In brief, Chim is sanguine, venturesome, trustful, friendly, and energetic, whereas Panzee was distrustful, retiring, lethargic. His behavior usually suggested unusual intelligence; hers stupidity.

In their relations to people the animals exhibited their usual diversity. Chim would go willingly to almost anyone who seemed friendly. Panzee's reaction was difficult to predict. Sometimes she would meet advances more than half way. Occasionally she would seek out a stranger. Both animals appreciated kindness. Panzee's mode of expressing appreciation was a gentle pat on her attendant's shoulder. This she administered rarely, and only when she was deeply grateful for friendly consideration. Chim has never been observed to express his feelings in this manner.[2]

Chim's preference for persons who were in a measure responsible for his care and conduct seems to depend chiefly on their disciplinary attitude. He approves them in the order of their indulgence. Those who allow him to have his own way and are pleasant and kindly about it hold first place in his esteem. Those who demand obedience and enforce reasonable regulations are respected, but not sought after! Chim when punished, or threatened with punishment, habitually strives to escape the disciplinarian. Panzee instead

[2] Miss Cunningham's young gorilla, Sultan, pats the shoulder of a human companion in expression of satisfaction or appreciation.

would crowd upon the person and strive to get into his arms. This remarkable difference in response to punishment deserves study. It may prove to be characteristic of sex.

Chim in a few instances exhibited his friendly spirit towar d human companions by bringing objects to them. A case in point is the careful plucking of some blossoms one day in the New Hampshire pasture and the presentation of them to a lady attendant.

Both Chim and Panzee when in the great out-of-doors romped more or less boisterously, he especially so. They also on occasion threw themselves on the ground with utter abandon and, relaxing completely, rested in obvious comfort. Frequently Chim would stretch out on his back in the pasture and with his hands under his head bask in the sunshine. Panzee never assumed this attitude. It was strikingly suggestive of a human attitude of relaxation. Opportunity for play was eagerly sought, especially by Chim, and occasionally by Panzee when she was feeling well. Chim went to considerable lengths to invent modes of amusement when alone and games that he could play with human companions or with Panzee. He is extremely fond of being chased about, also of chasing things which try to escape him. When playing with a person he expresses his emotions in two peculiar ways. The appearance of these expressions depends on his relation to the person and on his mood at the moment. With me he frequently stops, and shaking his left hand vigorously, completely relaxing it at the wrist, stands erect, and with mouth open and teeth exposed assumes a fighting pose. That this is play I have repeatedly demonstrated by putting my hand or finger into his mouth. He has never bitten me, but he immensely enjoys the mock attack and

defense. Sometimes he will jump up and down swinging his arms and waving his hands as if they were pivoted at the wrist.

The other amusingly expressive reaction in connection with play he has never exhibited in his relations with me, but several times when romping with a lady attendant or with a small group of admiring observers at hand. The act consists in either standing on his head or resting on his hands with head near the floor and throwing into the air either one or both legs, at the same time shaking it or them in a manner which suggests complete relaxation. This leg movement is similar to the hand movement described above. The whole performance makes the observer feel that he is trying to give one the chimpanzee "glad hand." The peculiar thing about it is that he should use his leg instead of his arm.

Fondness for music or at least for rhythm was exhibited by the animals, but more particularly, perhaps because of his more abundant energy and activity, by Chim. On occasion he would dance about keeping time to music and showing appreciation of rhythmic sounds and of the excitement attendant on music and human companionship. Panzee never danced and, although interested in music, gave no clear indication of satisfaction in it. It is not improbable that the dance movement in the young male is related to courtship behavior.

Although the chimpanzee is incapable of shedding tears, it exhibits its displeasure or discomfort by facial expression and by a combination of sounds and facial expression which may properly be described as weeping. Satisfaction and joy were expressed by my young animals in varied ways, among them the patting of shoulder, being peculiar to Panzee, and pronounced laughter, peculiar to Chim. The smile or laugh

occurred most commonly in response to favorite foods or opportunity for much desired companionship and play. Chim can be made to laugh by tickling him on the ribs. Panzee more frequently resented this treatment and tried to bite.

The common modes of expressing resentment, anger and rage are much like those of the child. In resentment the lips are protruded and there is a plaintive whine. In anger the lips are more likely to be drawn back exposing the teeth. The mouth may be opened and the whine is replaced by a scream. In rage these reactions are exaggerated and the animal is likely to throw itself on the ground and tumble about or whirl around as though on a pivot. Both Chim and Panzee, but Chim more frequently, exhibited all of these reactions. When refused some much-desired food he occasionally would scream loudly and throw himself about energetically, careless of his bodily comfort or welfare. I have seen the same sort of behavior in children of two to five years.

As contrasted with anger, the emotion of fear, with its incipient stage of timidity and its extremity of terror, gains expression in defense reactions. Vocal response usually is lacking. Instead of whining or screaming as in anger, the animal keeps perfectly quiet, as though to avoid attention. The pulse and respiration increase more or less markedly and as timidity develops into terror the hair becomes erect and the animal either holds itself tense and ready for flight, or, if the opportunity offers, silently steals away.

My best opportunity to observe fear reactions appeared in connection with brush fires and cows in the New Hampshire pasture. Chim was fearful of the open fire. Panzee paid little attention to it. Presumably experience is responsible for his behavior. His timidity in the face of fire either in the

fireplace or in the pasture expressed itself by silent attention, alertness, and preparedness for retreat or flight.

When the animals were together approached by a herd of cows in the pasture they exhibited the fear reaction noted above, but in addition Chim sought Panzee's side and kept his hand on her shoulder as though to protect and direct her. When the cows were near and a person either stood between them and the chimpanzees or was beside the latter, Chim frequently would beat the ground with hands, feet, or both, as though to frighten the strange creatures away. This he did only when his natural courageousness got the better of his timidity. I have never seen him do it when his hair was erect and body tense in preparation for flight. Panzee never exhibited any of the defense reactions. If terror stricken she either scurried away from the object of fear or sought human protector. Both animals had complete confidence in their human companions and relied implicitly on them for protection against harm.

The interest of the cows in Chim and Panzee was insistent. As soon as these little natives of Africa were brought into the pasture the herd, if the wind were toward it, would head for them as though drawn by some irresistible force. They would deliberately approach to within a few feet of the chimpanzees. Several times I demonstrated to my satisfaction that the odor of the chimpanzees was the determining stimulus. The cows never seemed satisfied with what they could see no matter how close they came to Chim and Panzee. On the other hand the chimpanzees were entirely satisfied with what they could see of cows at a hundred yards, and when they came to within twenty feet of them they exhibited extreme uneasiness even though in the arms of their caretaker.

Incidentally it was observed many times that extreme anger or fear in Panzee was very promptly followed by diarrhea.

Expressions of sympathetic emotion, although not lacking, were sometimes difficult of identification. Panzee, for example, would occasionally resent liberties which were taken with Chim and would, as it seemed, come to his defense by attempting to strike or bite anyone who was playing roughly with him. I at first thought that this was an expression of sympathy. Subsequent observations indicate that it was jealousy instead. Similarly, the interpretation of Chim's behavior toward Panzee when both were lonesome, frightened or discouraged by being left behind on a walk, is difficult. Casually observed, his attendance on her at such times and his evident efforts to push or pull her along, and indeed to direct her by placing both hands on her shoulders, or an arm about her waist, suggest sympathetic companionship, but continued observation indicates that his is far from unmixed altruism. It is always difficult to decide to what extent he is directed by selfishness at such times. When timid or fearful he inevitably seeks companionship. His presence beside Panzee, who may happen to be unconsciously sustaining his courage, looks altruistic, and there is no reason to deny the altruistic element, for when Panzee fell behind on our rambles because of her relative weakness, Chim often would respond to her cry of complaint by dropping back to help her forward. I recall once seeing him stand beside her in heroic attitude until the cows gradually approaching were within ten yards of them, when, evidently unable longer to control himself, he deserted her and made a dash for the nearest tree. Perhaps many men would have done likewise.

Expressions by Chim and Panzee of sympathy for persons

were abundant. They readily became attached to those whom they saw constantly and learned to trust. Of gentle disposition naturally, they are affectionate and loyal, appreciating kindness and, in case of Chim, at least apparently understanding reasonable discipline and even punishment.

NEST BUILDING

Nest building is one of the favorite play activities of the young chimpanzee. Perhaps I should say the young male, for in this case the female was not observed to construct any tree nests, although she rarely made incipient moves toward the construction of nests on the ground. Chim sometimes built several nests in the birch trees of the New Hampshire pasture in rapid succession. Again, a week or more would pass without any move on his part toward nest construction. The performance suggests innate equipment. The little male climbs a tree and suddenly begins to pull toward him the branches and twigs within easy reach. As he draws them in he tucks them under him. Some of the branches break off and these stay in place and help to hold those which are unbroken. If the materials within easy reach are not sufficient to make a good solid nest the animal breaks off adjacent small branches and carries them to the nest. In the course of five or ten minutes Chim can thus construct a nest of leaf covered boughs, usually located 10 or 15 feet from the ground in case of my observations, which will comfortably and safely hold him. On completing a nest he commonly would try it for a short time and then turn to some other form of amusement. In no case was he seen to construct a cover or roof or to attempt to cover himself while lying in a tree nest. His interest was limited to the process of construction; use was not involved and he was seldom seen to return to old nests.

He evidently preferred to make a fresh start in a new location each time.

On the ground or indoors nests may be constructed of almost any available materials—even a rug serving the purpose by being pulled together and folded.

Panzee once or twice was seen to climb a tree to look at a nest which Chim had built or to lie in it. Ordinarily, however, she paid no particular attention, either to the process of construction or to the completed nest.

Although in case of these young chimpanzees only the male built tree nests, it is reported by the observers of the Canary Island Station that all of their animals exhibited this form of activity. Presumably under the conditions of observation both in New Hampshire and in the Canary Islands nest building was primarily play or exercise. It may also have an element of practice.

To see the birches of a New Hampshire hill pasture filled with chimpanzee nests makes one feel queer. Perhaps the chimpanzees themselves feel at least as much out of place in this environment as the nests seem to us.

This account of the daily life, habits, and temperamental characteristics of Chim and Panzee, despite its lack of certain scientific attributes, is, I believe, justified by the paucity of our dependable knowledge of the nature of this race of anthropoids. While regretting the fragmentariness and obvious incompleteness of the observations which are reported, I am confident that they are worthy of record because few persons trained to the careful study of animal behavior have been intimately associated with young chimpanzees for months at a time.

CHAPTER V

Evidences of Insight

I have not given special attention to problems of sensibility in Chim and Panzee and the following statements are only roughly descriptive of the animals' equipment. Undoubtedly the sensory equipment of Chim and Panzee was excellent and in general comparable in usefulness to that of the normal man. Vision is clearly the dominant sense. Smell is used frequently and effectively as a guiding sense, especially in locating and testing foods. Touch, taste, and kinesthetic sensibility are also important.

OBSERVATIONAL ABILITY

The use of vision, ever impressive, varied greatly from time to time and with the two individuals. Chim, always alert and interested in everything within the reach of his senses, seemed never to tire of watching objects. Panzee, on the contrary, seemed indifferent to most aspects of her varied surroundings. When riding in an automobile Chim would sit up at attention almost continuously, looking at objects both near and distant and taking keen interest and satisfaction in appearances and happenings about him. Panzee was more likely to attend only to unusual appearances or events and to those which for one reason or another compelled interest or action. Similarly in case of distant vision, Chim was interested, Panzee was not. He has repeatedly been seen to gaze intently from the hilltop pasture into the river valley or to the distant mountains.

ADAPTABILITY

Of some value as evidence of the sort of intelligence which is designated as "insight" is the response of the animals to such unusual treatment as that of the surgeon and the anthropometrist. When Chim and Panzee were treated for hookworm, Chim, although much stronger and therefore more able to resist the treatment than Panzee, quickly submitted to having his jaws wedged apart, the stomach tube placed in his throat, and the drugs administered. He acted as though he were willing to accept the situation on faith and relied on our judgment. Panzee, by contrast, struggled from first to last against the insertion of the jaw wedge, of the stomach tube, and the administration of the medicines. She took nothing for granted and exhibited no confidence in us or willingness to adapt to what evidently struck Chim as the inevitable. This is typical of the behavior of the animals in connection with medical and surgical experiences.

Again, when attempt was made to weigh the chimpanzees Chim permitted himself to be placed in the basket of a scale and, although obviously puzzled and slightly disturbed by the unusualness of the situation, he sat quietly until the reading had been made. When effort was made to put Panzee into the basket she scrambled out unceremoniously and continued to do so with each repetition of our attempt. Finally as a means of circumventing her unadaptability, the idea came to me of placing the animals in the basket together so that she might be assured by Chim's presence. The first time this was tried Panzee scrambled out, but with less show of alarm and resentment than formerly. The second time she remained for a few seconds. Subsequently it was possible to read the combined weight of the animals and by sub-

tracting Chim's to obtain hers. After a few repetitions of simultaneous weighing of the two animals Panzee became so accustomed to the basket that she would sit in it alone quietly. This observation indicates, among other things, the marked difference in adaptability of the two animals.

Another illustration of adaptability is supplied by the reaction of the animals to a home-made stadiometer which was so planned that standing and sitting height could be readily obtained. The apparatus required that the animal be stretched at full length on its back, with head firmly against an upright headboard, legs stretched, and feet against a movable foot-board. Naturally both Chim and Panzee objected to being so placed. Chim, however, very quickly learned to accustom himself to the unusual position and procedure and permitted us to make the readings satisfactorily. For Panzee it required many more experiences to establish the same degree of adaptation.

The measurement of head height by the Hrdlička procedure and with the use of the head caliper and an additional scale placed on top of the animal's head offered peculiar difficulties and was extremely alarming, if not also uncomfortable, to the animals. It therefore provided a unique opportunity for a rough measure of adaptability. What disturbed the animals most was having the ends of the head calipers inserted in the external auditory meatus. Neither Chim nor Panzee became reconciled to this experience. Each time the measurement had to be repeated, Chim fought the insertion of the tips of the calipers. In at least three instances, after repeatedly pushing aside the calipers and preventing the observer from securing a reading, Chim suddenly became quiet and let us apply the calipers and make the reading with entire satisfaction. It was as though after repeatedly ex-

pressing his dislike of the procedure he all at once made up his mind that it was inevitable and might better be got over with promptly. Panzee, although disliking the experience, objected less strenuously than Chim, and on the whole gave better opportunity for this particular physical measurement. On the other hand she never showed the sudden change from resistance to acceptance that appeared in Chim.

These four instances of differences in speed and degree of adaptation to unusual circumstances are selected from many which might be described. They will suffice to suggest at least the order of difference between these two young chimpanzees.

INSIGHT AND IDEATION

Both Koehler and the writer have concentrated attention, as research opportunity offered, on the study of ideational behavior in the anthropoids. The writer has presented in another connection (12) evidences of insight in a young orang-utan, while Koehler has presented strikingly similar, although more numerous and varied, evidences of ideational behavior in adolescent chimpanzees (9). This report presents certain evidences for chimpanzees which are much younger than any observed by Koehler. According to his estimates the age of his subjects ranged from six or seven years upward.

Since the results now to be reported are qualitative merely, it will be unnecessary to describe in detail the situations which were contrived by the experimenter to test or exhibit whatever insight the animals might be capable of. This statement does not imply that the situations were casually arranged, or the observations carelessly made. Instead, every attention was given to essential features of the tests,

and the behavior of the animals was accurately noted and recorded.

Inasmuch as the desire for food is a strong and dependable motive for effort, food was used as reward in all of the tests which are now to be described.

To begin with I shall present in some detail, by quotation from my notebook, the behavior of Chim in the first type of test situation.

In an observation room approximately 22 feet long, 12 feet wide and 7 feet from floor to top of beams, with space between beams and roof, a string was suspended to which a banana could be attached at any desired height from the floor. This string could not be reached from any point in the room by the animals. In fact, the nearest approach by side walls or overhead beams was approximately four feet.

The first record reads as follows:

At 4.35 a piece of banana was attached to string approximately 150 cm. from floor. Single rope which was attached to middle of outer beam for animals' play had previously been lightly fastened around beam so that it should be out of the way as I supposed Chim would naturally use it to climb and swing on and might accidentally discover that banana could be approached by means of it.

He was interested immediately in the banana, watched me intently while it was being put in place, looked about the room, climbed up to the outer beam, seemingly measured the distance with his eye, swung on the looped rope which was fastened to the beam at both ends and at one point hung about a foot below beam, descended to floor, looked up at banana, went to outer corner of room and climbed up on Miss Mumpoting's lap as though seeking help, gazed at her a few seconds, climbed down, took another look at the banana, climbed up on outer beam, then down to loop of rope and sat or lay astride the loop swinging there reflectively for perhaps a minute, climbed down again to the floor. It was now 4.45. The end of rope had been lightly wrapped around beam. I noticed it to be loose and when a minute or two later Chim

again climbed to top of beam his first pull on the rope freed it and allowed it to swing as usual from middle of beam to within a few inches of the floor. As soon as the rope swung free from the beam he scurried down to the floor, seized it and began to swing on it some 2 feet from the floor, looking at the banana constantly. Twice he allowed himself to swing with the rope. The movement was almost entirely rotary, but he controlled it perfectly, causing himself either to spin around or to hang quietly without touching the floor. Having made this swinging test and observation, he dropped to the floor and holding the rope with one hand ran back with it for 5 feet toward the outer end of the room. He then threw his weight on the rope and allowed it to swing him toward the banana. The first swing brought him within 2 feet of the banana. The second time he swung still further, and on the third attempt he grasped it and dropped quickly to the floor to eat it. Time, 4.50. The whole period of effort was about fifteen minutes and during this time his attention seemed to be almost continuously directed to obtaining the banana.

I next measured his reach standing on the floor and discovered that he could easily reach 70 cm. I therefore placed a piece of banana on the string at 100 cm. from the floor. Almost before I could step back he was under it and with one spring upward grasped and secured it.

In order to discover what he would do when the banana was placed so high that it could not be reached from the swinging rope, at 5.10 I placed a piece on the string 180 cm. from floor with the rope hanging free as usual in middle of beam. He immediately made a general survey of the situation, then climbed to rear beam, scrambled along it and with his hands felt the edge of rafter leading toward banana. The roof boards fitted so closely that he could get no hold, so he turned back and dropped to the floor. Almost immediately he ran to the outer beam, climbed up and resting on it pulled the rope up to him. Stretching himself out on the beam he grasped the rope with one hand, looked toward the swinging banana and jumped for it, one arm outstretched, the other holding the rope. His aim was perfect. He grasped and held the piece of banana and with scarcely a jerk because of the skill with which he had measured distance and rope, he swung back, dropped lightly to the floor and ate his prize. Less than five minutes elapsed between the beginning and the end of this observation. Attention and effort were continuous.

Chim was now removed to living room and preparations were made for box stacking test. The continuity of attention, rapidity of motion,

initiative and versatility of this chimpanzee are remarkable in contrast with those of Julius (an orang-utan).

A few days later, in summary comment on the behavior of Chim in this initial type of situation, the following record appears:

> In the banana and string experiment he has thus far used his experience and skill in climbing with or without rope, in jumping and in swinging from it. His versatility and skill in securing the banana thus are very great. The methods which he has thus far used with success are (1) springing from floor and seizing banana; (2) seizing rope, running back and swinging on same until banana can be reached; (3) seizing rope while above floor, swinging on same by body contraction and seizing banana; (4) mounting beam, drawing up rope, holding same with one hand and grasping banana with other as he jumped toward it; (5) swinging from under side of beam and trying to grasp it as he hurtled past. I record this as successful because he evidently could get the banana in this way if permitted to take the risk. He also examined the possibility of climbing along rafter and has given indication of desire to jump from beam directly toward banana.

The second test of insight was made with the aid of a bottle about 12 inches long, 4 inches wide at the bottom and 2 inches at the top, the neck of which projected through a hole just sufficient to allow for it in a box 6 inches deep, 20 inches long by 15 inches wide, the side of which next the floor had been removed. Into this bottle in the presence of Chim a banana was dropped. As the neck of the bottle was too small to admit the hand of the animal, the easy way to secure the reward was to turn the box over, pull the bottle out and inverting it, shake the banana out of it.

With this device Chim was given several opportunities to experiment. The greater part of his time and effort was given to trying to force his hand into the bottle or attempting to haul the bottle, neck first, through the hole in the box, a

feat which was impossible because the bottom of the bottle was larger than the top. It was only after two or three hard-won successes in attaining the reward that Chim took to turning the box up and pulling the bottle out from beneath. This method, I think, was achieved rather by accident than by insight. At any rate the animal's behavior did not suggest the effective use of ideas.

A method which both Koehler and the writer have used to advantage in testing anthropoid ideation is the so-called "box stacking test." A young orang-utan tested with this method achieved success only on the basis of imitation. Certain chimpanzees observed by Koehler, on the contrary, stacked boxes spontaneously and with considerable skill in order to obtain suspended banana. It must not be forgotten, however, that Koehler's animals were much older than Chim and Panzee.

The setting of the box stacking experiment may be briefly described as follows: A light strong cord was attached to the ceiling of a room approximately 8 feet high. The nearest point from which the animal could reach toward this cord was more than 5 feet distant. To the cord a banana was attached at distances from the floor ranging from approximately 150 to 200 cm. Three boxes were provided for the animal's possible use, each with one open side. The boxes differed in size in accordance with the following dimensions: no. 1, 16 by 12 by 11 inches (one 16 by 12 side open); no. 2, 16 by 10 by 9 inches (one 16 by 10 side open); no. 3, 11 by 11 by 10 inches (one 11 by 11 side open). These boxes were placed on the floor of the room within convenient reach of the string, but so far from it that the animal could neither reach from them nor spring from them to the reward without moving them.

As it was ascertained in advance that Chim could by springing reach an object approximately 100 cm. from the floor, the banana in the first instances was placed 150 cm. from the floor.

In this test the initial use of a box to reach or spring from came slowly. Chim exhausted all other possibilities of approaching the reward before finally attempting to move one of the boxes. Having tried this experiment and discovered that it worked he very naturally came to drag the boxes about and place them to suit his purpose. Then came a period of resourcelessness when the banana was placed at such a height from the floor that it could not be obtained by the use of any single box. Under these conditions Chim wasted one full period (usually about thirty minutes) of observation.

The utilization of two or more boxes appeared suddenly and without warning as described below.

At 6.30 p.m. on August 27 and before the evening meal, the box stacking test was arranged. Chim was in fine working condition. The string was baited with a large banana placed about 150 cm. from the floor. The three boxes were placed about the room at least 2 feet from a point directly beneath the banana.

Chim made no move to get the banana until I left the room. Then he turned to his task directly and with extreme energy and evident determination.

First he sprang a few times from box 1 in its original position, but it was too far away for him even to touch the banana. Promptly abandoning this method he seized box 3 and moved it toward the center, leaving it perhaps 12 inches off center. From this box, thus placed, he jumped in rapid succession twenty or more times, working with utmost persistency and energy. Stopping he turned suddenly toward the rear side of the room and pulled a blanket from peg to floor. I supposed he

was going to use it in some way, but instead he immediately dropped it, left it lying on the floor, and returned to box 3 from which he jumped two or three times.

Then, with no hesitation, he seized box 3, carried it directly to box 2 and placed it thereon with its open side uppermost. He now tried to stand on the edge of box 3, but as this proved an unstable point from which to spring, he immediately abandoned it, having made only one or two futile efforts to spring from the stacked boxes. He next pulled box 3 from box 2, carried it to box 1 and placed it thereon insecurely. Immediately he mounted the boxes and skilfully balancing on box 3 as it rested on box 1, he jumped toward the banana. At the same time box 3 fell to the floor, but Chim seized the banana as he sped through the air and eagerly devoured his reward.

This whole performance required less time than it takes to describe it because he worked with great rapidity, jumping so hard and repeatedly that at times I was afraid he might injure himself. The total time from setting of experiment to success was less than five minutes.

Thus with surprising suddenness appeared the perfect solution of the box stacking test. Subsequent opportunities to meet the situation adequately resulted merely in the perfecting of method. It is needless to describe the process. Chim had gained the necessary insight for the solution of the problem. That insight came not by suggestion from the experimenter, as in the case of Julius, the young orang-utan, but through observation, apparently supplemented by reflection.

The suddenness of Chim's success in the box stacking experiment suggests the orang-utan's solution of a multiple choice problem (12). The animal, after many days of effort which seemingly brought the solution no nearer, suddenly achieved success. Seemingly the problem was solved overnight. The only reasonable explanation of such sudden and radical change in behavior is insight. Koehler has described similar behavior in adolescent chimpanzees. It was, how-

ever, farthest from my expectation that Chim, scarcely beyond his infancy, would stack boxes without suggestion or tuition.

In the box and stick test Chim failed. A long narrow box, measuring approximately 5 ft. by 4 by 4 in. was fastened to the floor of a large room. In the middle of this box was placed a banana which could be seen through wire screened lid, but which could not be reached by the animal from either end. On the floor of the room some feet distant from the box lay two sticks which were light enough to be used readily by the little chimpanzee and each sufficiently long to be used to push the banana out of the box.

Although Chim on four different days was given from fifteen to thirty minutes to work for the banana, he made no attempt to use a stick to obtain it. Occasionally he would pick up a stick to play with it, sometimes dragging it about the room, but never did he show any sign of appreciation of the stick as a possible tool or instrument to secure the banana. This test was not long continued because of the intention of the writer to present it subsequently when Chim is somewhat more mature. It is worthy of note that the young orang-utan several times referred to solved this problem with relative ease, promptness and effectiveness.

Most surprising and impressive in Chim's behavior was the continuity of attention, high degree of concentration on his task, evident purposefulness of many, if not most, of his acts, his systematic survey of problematic situations, his rapid elimination of unsuccessful acts or methods, and his occasional pauses for reflection. I use this term without apology, even to the behaviorist, for the simple reason that if Chim were a child instead of a chimpanzee we should apply the term without hesitation and with assurance that it would

convey to every intelligent reader what is intended. I have never seen a creature give more convincing signs of reflection than does this young chimpanzee when spoken to or commanded in an unusual way or when some new and strange object is presented to him. His behavior suggests the puzzled air and thoughtful attitude of a child who faces a new situation. That this description of Chim's behavior is unsatisfactory I admit. Undoubtedly we should seek to verify our objective data and so to supplement them that we shall know with reasonable completeness the physiological counterpart of the attitude which is spoken of as one of reflection. Nothing is positively proved, beyond the ability of the animal to meet certain novel problems, but the unprejudiced observer, no matter how highly trained in scientific procedure, certainly would grant that Chim seems to have ideas and to utilize them frequently if not fairly continuously in his adaptive behavior.

Once more it must be emphasized that these so-called tests of insight are merely formal examples of situations which supply opportunity for adaptation. The test situations which accidentally or unintentionally appeared during the several months of my study of the young chimpanzees are too numerous to enumerate, still less to describe. Only one or two will be mentioned.

Chim's daily life supplies varied evidences of ideation. Witness the following contrasted behavior of Chim and Panzee when given the half of a large juicy orange cut at right angles to the segments. Chim after a little experimentation learned to extract the pulp without losing a drop of the juice. His method is to hold the orange with one or both hands and beginning at the edge, without breaking the skin, with lips and teeth to extract the pulp from one or more

segments. This done he rotates the object slowly and similarly takes the substance of the next segments. Thus he systematically devours the orange. Having extracted the juicy portion, he pulls out the remaining membranous parts and there remains the clean skin, usually turned inside out. In case the half orange happens to be small and very juicy he is quite likely to apply it closely to his face and suck it dry without moving it.

Panzee's technique in eating a half orange was crude and imperfect by comparison. Her method varied greatly and commonly resulted in the loss of more or less of the juice. She usually managed to so mutilate the skin that it was difficult to get all of the substance.

Chim's method strikes one as peculiarly clever or intelligent. Her behavior, on the contrary, seemed rather stupid or careless. Although this description perhaps does some slight injustice to Panzee's native endowment it does not exaggerate the contrast in intelligence of the two animals.

Without complete knowledge of the life history of an animal it is quite impossible to estimate the contribution of experience in any given situation. Since the infrahuman primates are known to be extraordinarily imitative of the activities of other members of their own race and also of other types of primate, it is obviously important that students of primate behavior have complete knowledge of the history of their subjects. This knowledge in the case of Chim and Panzee is lacking. Although unfortunate, this is not exceptional, for the literature contains no single account of an experimental study of the behavior of an anthropoid ape whose life history has been carefully observed and faithfully recorded from birth.

More important than the presence of imitative tendency

in the infrahuman primates is its specialization, selectiveness and restriction. In order to be safe I must at once particularize and limit my statements to the pair of young chimpanzees which I have observed. Many human acts are intently watched and eagerly imitated by the chimpanzees. Panzee, it is true, imitated only rarely even the acts of Chim, but he always was ready to try things which he saw his human companions do. Scrubbing and sweeping seem to have peculiar fascination for him and after seeing a person use cloth, scrubbing brush or broom he would try to use them. Doubtless the use of stick, hammer, nails, saw, etc., in his presence would stimulate imitative effort. He has been tried many times with a ball and has slight tendency to imitate throwing or rolling it although he is usually ready to try to catch it as it comes toward him.

Among the most amusing and perhaps also significant instances of imitation are the following.

A boy of twelve who was playing with Chim in the New Hampshire pasture one day began to spit to see whether Chim would imitate him. Chim watched with keen interest and perfect attention. Almost immediately he tried to spit. His initial efforts were amusing if not effective. The following day in the observation room he was seen off in a corner practising spitting, having achieved in the meantime a fair degree of proficiency. As this performance was promptly discouraged the story stops here.

Panzee after being bitten slightly in the finger by Chim during one of their rather rough games was seen shortly thereafter trying to wrap a bit of cloth about the wounded member. Although this incident is described under imitation I cannot be positive that it was imitatively performed.

Certainly Panzee had had previous opportunity to observe the use of pieces of material as bandages.

Such examples or illustrations of seemingly intelligent imitation of acts within the species or without it might be greatly multiplied.

Inasmuch as speech finds its source in imitation it is logical at this point to introduce a general account of the vocal reactions of Chim and Panzee. This account is merely prefatory to a special report on the sounds and speech of young chimpanzees, by Mrs. William S. Learned, which constitutes the second part of this volume.

CHAPTER VI

Sounds and Speech

Vocal reactions are frequent and varied in the young chimpanzee, but speech in the human sense is absent. Although the animals have a sound producing apparatus which presumably is capable of functioning much as does that of man, there is slight, if any, tendency to imitate sounds. Chim and Panzee would imitate many of my acts, but never have I heard them imitate a sound and rarely make a sound peculiarly their own in response to mine. As previously stated, their imitative tendency is as remarkable for its specialization and limitations as for its strength. It seems to be controlled chiefly by visual stimuli. Things which are seen tend to be imitated or reproduced. What is heard is not reproduced. Obviously an animal which lacks the tendency to reinstate auditory stimuli—in other words to imitate sounds—cannot reasonably be expected to talk. The human infant exhibits this tendency to a remarkable degree. So also does the parrot. If the imitative tendency of the parrot could be coupled with the quality of intelligence of the chimpanzee, the latter undoubtedly could speak. For, as already pointed out, it possesses a vocal mechanism comparable with that of man, and also a type and degree of intelligence which would enable it to utilize sounds effectively for purposes of speech.

Chim and Panzee, with excellent voices and ability to produce a wide range and a great variety of sounds, yet exhibit only a few types of vocal reaction. Certain sounds, it is true, are characteristic of certain situations, as for ex-

ample, situations or objects which are desired or liked, disliked or resented, avoided or feared, and so on. Our observations of the animals' vocal reactions, our descriptions of them, and our attempts to interpret them, constitute the materials for the remainder of this volume. It is my final task to tell of systematic efforts to teach Chim to speak.

After short acquaintance with the animal I concluded that he would be an unusually good subject for speech tests. Plans were therefore formulated for systematic training.

Thus far during the past eight months, four methods of speech instruction have been tried, and each in turn abandoned because of lack of positive results.

In one wall of the observation room at Franklin, New Hampshire, a small hole was cut to permit pieces of banana to be delivered through a chute to a small receiving table in the observation room. My thought was that the experimenter by going to this hole from time to time and making such a sound as "bă, bă" in response to which pieces of banana would appear on the table, might not only attract the attention of Chim to the relation of the sound to the much desired fruit, but stir him to attempt to make the sound on his own account.

Once or twice a day for a period of some two weeks this training test was conducted. Chim, at first greatly interested in the performance and eager to get pieces of banana, gradually lost interest in everything except the food. He made no attempt to reproduce the sound and the method was finally abandoned as unsatisfactory.

Some weeks later a box was constructed in which pieces of banana could be held ready for delivery on a little shelf or table at the base of apparatus. This mechanism was arranged so that it could be hung on the wall of the animal's

cage and operated at will by the experimenter. Each day at a stated hour the observer would place the apparatus in position, having loaded it in advance with six pieces of banana each about an inch in length, and would call Chim to attention. With him beside the apparatus and watching intently, the sound "cō, cō" was made distinctly and emphatically a few times, whereupon a piece of banana suddenly appeared on the table. Sometimes Chim was allowed to have the banana, and again the experimenter took it in order to continue his interest and attention, and if possible increase his eagerness for the reward. Occasionally this procedure induced certain lip movements seemingly in imitation of those of the experimenter. Rarely, and as if by accident, Chim would make a sound. Certain slight and unconvincing intimations of attempts to make sounds when facing this apparatus appeared. The training test was continued for several weeks with regularity but, apart from the above encouraging signs, with negative results.

Another type of device consisted of a board on which was a small box hinged on one side and provided with a spring which when released would raise the box and uncover a banana. This box had a wire mesh cover through which Chim could see the banana.

Having placed a banana in the apparatus the experimenter would take it into the cage and having secured Chim's attention, would make the sound "nă, nă" distinctly and emphatically a few times, thereupon releasing the apparatus so that the banana was uncovered. Usually the observer seized the banana and began to eat it, thus intensifying the eagerness of the animal. In the second or third trial Chim was allowed to get the banana and eat it whether or not he made a sound. This method also, although tried until

the interest of the animal practically disappeared, yielded wholly negative results.

The experimenter succeeded in training him to speak for food as a dog may readily be taught to do. This he did, however, not in imitation of the trainer but to secure the food.

Throughout the period of observation effort was continually made to interest Chim in human speech and in the production of sounds. He was talked to a great deal and naturally learned to respond properly to certain sounds or if not to the sounds alone, to the situations which they accompanied. Occasionally he seemed to try to talk when persons were talking in his presence.

Although superficially considered these speech training tests are discouraging they have served to throw valuable light on certain of the characteristics of the chimpanzee and have made possible the formulation of problems which are well worth experimental attack.

II

VOICE AND "LANGUAGE" OF YOUNG CHIMPANZEES

BY

BLANCHE W. LEARNED

CHAPTER I

Introductory Remarks

The records of vocal expressions presented in this volume were made under peculiarly advantageous conditions since the animals, although under control, were given a large degree of freedom and were subjected to varied conditions of observation. The study of vocal reactions, although far from exhaustive, offered such interesting materials that it was decided to publish immediately. No review or discussion of other reports on voice or speech in the young chimpanzee is given because nothing similar to these descriptions in musical notation has been discovered.

The method used in recording the utterances presupposes considerable training and experience in aural exercise and is, perhaps best compared with the taking of dictation. The element of memory came into the work occasionally. Invariably the utterances were recorded immediately after they were heard. In addition to description of sound, the situation in which it occurred was carefully recorded. No attempt was made to discover the significance of sounds until the observational task had been completed and effort begun systematically to arrange observations. It then appeared that classification by type of situation seemed both natural and useful. The records consequently were arranged in four principal groups which may be described briefly thus: Vocalization while waiting for food; while eating; when in company with persons; and when the two chimpanzees were together.

To supplement the observation of Chim and Panzee, the

principal sounds made by the adult chimpanzees at the New York Zoölogical Park were noted. These are reported briefly for comparison with the vocalizations of the young animals.

The description assumes that the reader is familiar with simple musical notation, yet one who knows only the most common signs, such as the dynamic marks, the staccato and legato symbols, and the rhythmic value of notes and rests, can appreciate most of what is recorded. Bar-lines indicate pauses of varying length.

As the observations covered a period of several weeks, a continuous story was impracticable. The episodes, however, are in general consecutive, especially those dealing with food, and they have been selected from an abundance of records as either typical or significant because of the circumstances.

Various minor difficulties appeared in connection with descriptive nomenclature. Chim's "whine," for example, is not necessarily complaining. Yet the term "whine" seemed best to describe these unvocalized tones.

Although the young chimpanzee uses significant sounds in considerable number and variety, it does not, in the ordinary and proper meaning of the term, speak. Consequently there is no chimpanzee language, although there certainly is a useful substitute which might readily be developed or transformed into a true language if the animals could be induced to imitate sounds persistently.

CHAPTER II

Sounds Associated with Food

CHIM WAITING FOR FOOD

Early morning. When their room was first opened, Chim gave an unique call. It was, perhaps, the most remarkable of his utterances from the vocal standpoint, and consisted of two tones, widely separated in pitch, but sounding simultaneously. This seems a strange phenomenon to one used to the limitations of the human voice. The presence of two ventricles, or sacs, in the throat which are much larger and more flexible in the ape than in man serve to intensify the voice and increase the volume.

As indicated below, these tones were very loud, the upper ones piercingly shrill and clear. The lips were drawn well back showing teeth and gums. With this greeting he held out his arms in welcome, eager to be taken up.

1

Morning. He began his call with the upper tones alone, increasing the volume until he burst into the double tones. These calls contain the most dissonant interval in musical structure, the minor second (f sharp and g). They are three

* 2 over 8 va. signifies two octaves above the notation.

octaves apart in register, however, which somewhat softens the effect of dissonance.

2

Morning. He whined impatiently and screamed his double-tones:

3

Again he whined, and screamed repeatedly:

4

Morning. Greeted us with a soft whine:

5

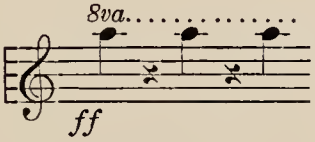
and screamed while holding out his arms to be taken up:

6

Morning. Chim did not offer his usual hearty welcome. He remembered no doubt, that he had had to work for his breakfast the day before. (See experiments nos. 34–51). He uttered but a single tone:

7

And later this shrill cry of disappointment:



8

Followed by *gahk, gahk:*

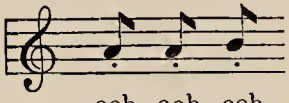
9

Gahk seems to be the root word for food in chimpanzee language. It has several variants (see Boma's records nos. 295–298) one of which is *ngahk.* The nasal is somewhat prolonged seemingly to express greater enjoyment, as a child

often uses the nasal *m* for the same purpose. This *gahk* is significant here since it was the usual time for Chim's breakfast, and there was no breakfast in sight. He watched the preparation for the experiment as he moved about restlessly. When Dr. Yerkes went out of the room he whined:

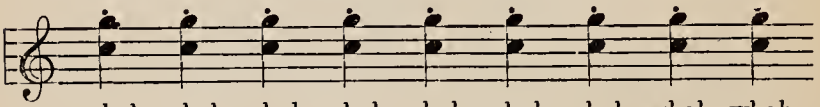
10

and seeing the writer rise, he pouted his lips saying *ooh-ooh-ooh* in a plea not to be left alone. This word is rare with Chim but very frequent with Panzee.



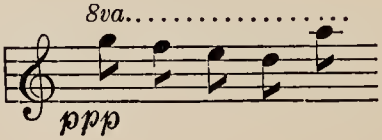
11 ooh, ooh, ooh,

Chim seemed excited and very hungry as he saw his supper being brought. He barked repeatedly somewhat like a dog:



12 whah, whah, whah, whah, whah, whah, whah, whah, whah,

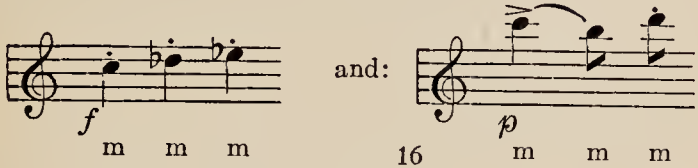
A change in procedure. Chim was to have the first course of his breakfast, a bowl of oatmeal, before the experiment. He saw Dr. Y. approaching with his tray and seemed to doubt whether it were for him. Very softly:



13

Morning. He uttered this attractive phrase as his oatmeal was being brought:

Dr. Y. came with guests to the observation room. Chim's greeting was:



He seemed very restless, moving about and whining:

He whined looking toward the kitchen door which was some rods distant:

Seeing Dr. Y. leave the house with his tray he uttered an exaggeration of the motive for fruit, the movement being downward as before but with the interval extended to a whole tone over an octave and the accent very sharp.

Evening. He whined as supper was brought:

20

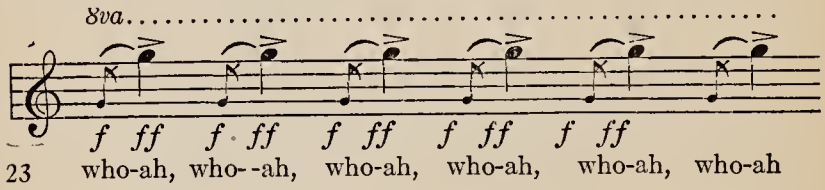
While waiting for breakfast:

21

The next morning:

22

Evening, after a very active afternoon in the open, spent in playing leap-frog and in riding the birches. He was without question very hungry and showed unusual emotional stress in a series of broken octaves. He spoke rhythmically and with the deliberation of a pronouncement as Miss M. appeared at the door with a tray of supper.

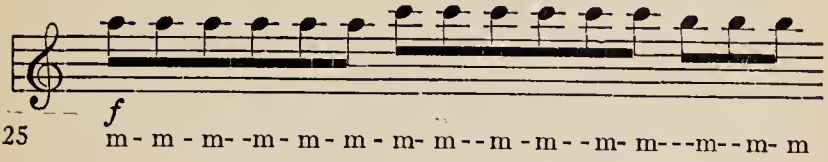


23

There followed these two examples of his phrase for fruit:

24

Again, in the evening, as supper was being brought, he expressed approval:



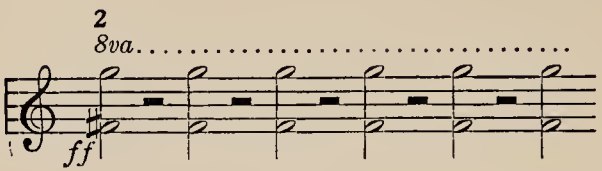
Morning. No experiment for several days. Chim reverted to his exuberant two-toned call:

and the phrase for fruit:

Morning. Chim yelled at the sight of food:

and whined:

Again he called loudly:



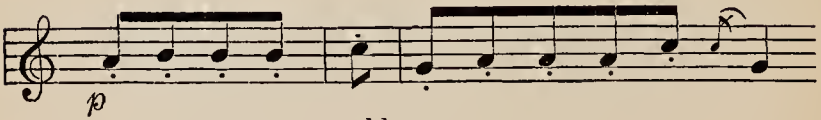
30

and whined, ending with the fruit motive:

31

Evening. Chim was irritable. It had been a fine day, but he and Panzee had not been taken for their usual outing in fair weather, and the time had probably seemed long. He had treated Panzee very roughly (see no. 73). He greeted the approach of their supper with this loud scream followed by whining, then the food word, another whine, and the fruit motive:

32



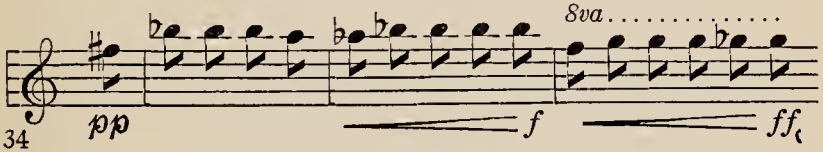
33

CHIM'S "REMARKS" IN EXPERIMENTS

Occasional mention has been made of certain "experiments" which were made to test and analyze the intelligence of the chimpanzees. In a few of these, Chim's vocal behavior was noted and inasmuch as all of them involved food, either as inducement or as a reward, they are introduced as a conclusion to the present chapter.

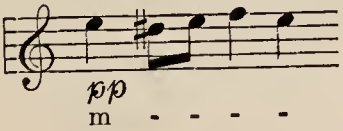
This experiment took place in the morning before Chim had eaten breakfast:

During his efforts to solve the problem he whined softly, at first, but grew increasingly impatient raising his voice in pitch and increasing its volume:

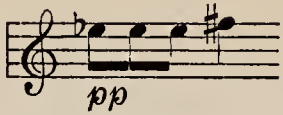


He finally burst into his loud scream:

Continuing his endeavor, he alternated his piercing single and double-toned scream with whining phrases throughout the test. The whining varied in loudness from a fine pianissimo to a forte. They were beautiful tones and rather pitiful in their appealing quality:

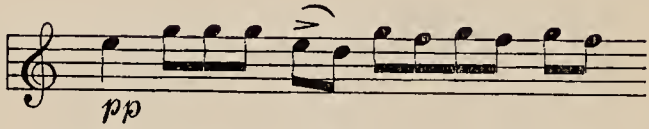


Pause:



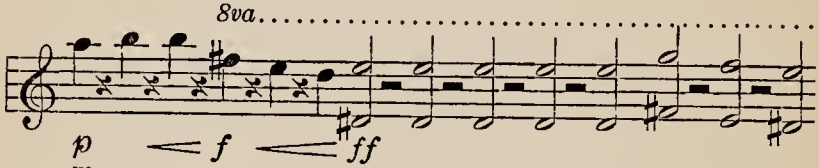
37 m - - -

Pause:



38 m - - - m - m - - - - -

Became irritated again:



39 m - - - - - ae ae ae ae ae ae ae ae

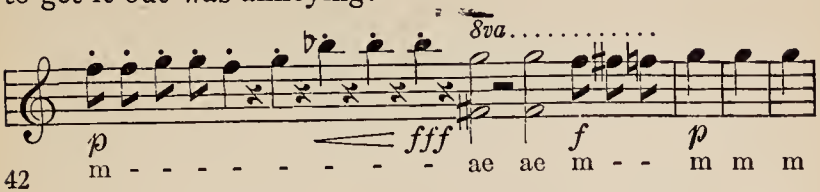
Complained softly:

40 m - -

Called angrily:

41 ae ae ae

To have a banana in a bottle, and to be obliged to think how to get it out was annoying:



42

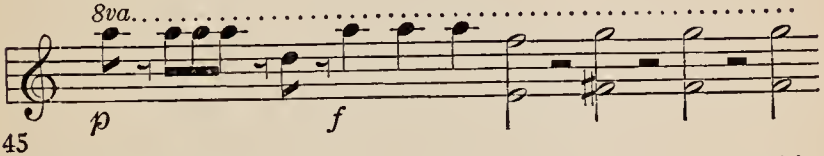
His friend Miss M. appeared in the yard and these rapid tones followed:

43

Dr. Y. urged him to get the banana, and his tones increased in rapidity and intensity, also rising in pitch, until he reached the climax of his tonal expression again:

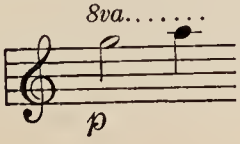
44

Then complained and called:



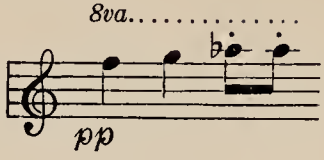
45

A pause, during which he seemed to be working hard on his problem; then softly:



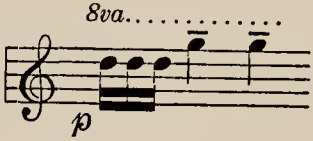
46

A pause, and very softly:



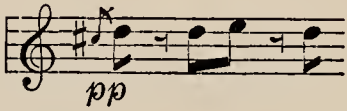
47

A pause and this:



48

Another pause and:



49

A prolonged pause and:

50

Then:

51

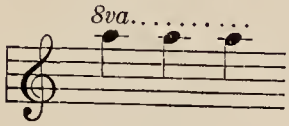
when a bowl of oatmeal was brought to him. *Nghak* is a sound that Chim used frequently when eating and when apparently well pleased with his food. (See Eating Nos. 74, 81, and Boma no. 295.)

The next experiment he took more philosophically showing a

disposition to adjust himself to new, though difficult, conditions. Two contrasting utterances were first: Softly:

52

And shrilly:



53

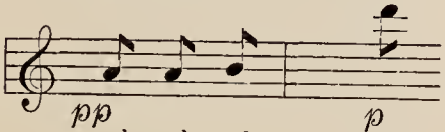
A pause and a variant of the food word:

54

And:

55

Then fearing that the only person in the room was about to leave him, he called pleadingly:



56

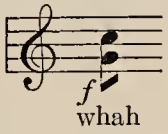
The procedure was changed somewhat for this experiment. Chim was given a bowl of oatmeal beforehand, and he worked with no one in the room.

He was very subdued, whining but a single tone:

57

But judging by thumps and other noises that emanated from the room he was busily working.

When Dr. Y. went in to change the arrangement of the apparatus Chim uttered a loud bark:



58

(See no. 97–107 for Chim's behavior immediately after this experiment in which he made up for the long period of quiet.)

Another experiment, after the oatmeal course, in which he was successful in piling up boxes to reach a banana that was suspended above him. He was silent in striking contrast to the first experiment which seemed to be a long difficult experience.

Again alone during the experiment he uttered a single phrase:

59

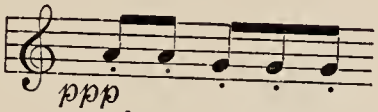
PANZEE WAITING FOR FOOD

The opening of the wooden outer door of the chimpanzees' sleeping room was the first thing on their day's program. The inner door was a heavy wire screen which served as pro-

tection as well as to let in air and sunshine. Chim always appeared at the screen upon hearing footsteps approaching or before. Panzee, also, sometimes left her nest to watch their breakfast being brought from the house across the yard. One morning she said approvingly:

60 ooh - ooh - ooh

Another morning, very softly:



61 ooh-ooh-ooh-ooh-ooh

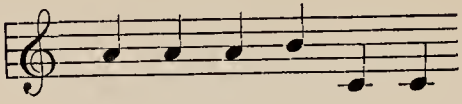
And another, more deliberately:

62 ooh - ooh - ooh

Evening. Panzee was much upset. Dr. Y. was absent, and Panzee, always a stickler for the established order, greatly disapproved of having any one else perform the sacred rite of feeding. She stalked from the observation room to the sleeping room, where they ate, with an indiscribable air of offended dignity, stamping her feet gently and raising her fur—always an evidence of emotional excitement with both animals.

She first whined, then screamed in loud, double-toned, and truly chimian fashion; then as she saw that the supper was really to be served by another than Dr. Y. she flew into a passion, crouched low on the floor, and screamed, showing her

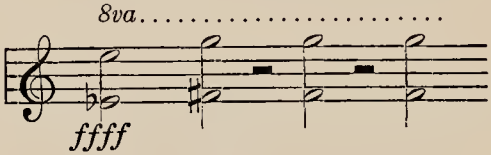
teeth, and whirling about in anger again and again. Her whine was this:



63

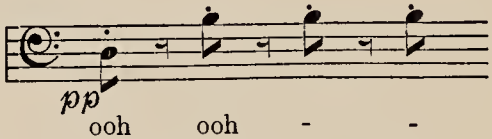
and her screams:

64



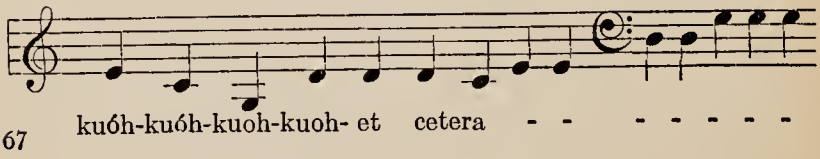
65

The following morning she uttered these soft tones while waiting for breakfast:



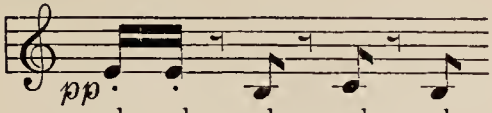
66

Evening. As we approached with supper, Panzee greeted us with these unusual sounds, resembling barks:



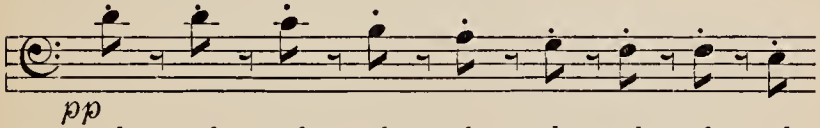
67

Another phrase uttered softly:



68

Morning. Standing close to the screen, waiting for the outer door to be opened she seemed in a happy mood, and greeted us with this dainty phrase:

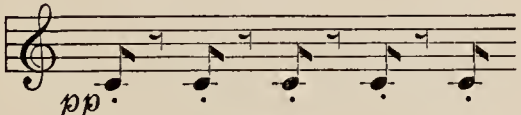


69

As we approached with supper she called enthusiastically to us with *gah*. As is shown in the vocabulary, the food-word has several variants of which this is one. In this record not only are the tones rhythmically symmetrical as to length but also as to the number in each group:

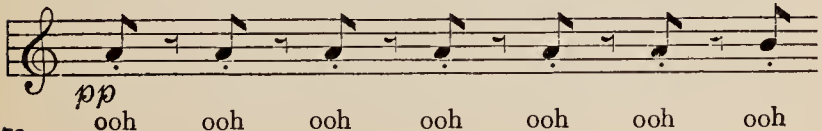
70

Morning. As we came with breakfast Panzee called softly:



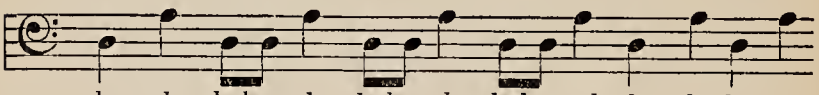
71

And on another morning, very softly:



72

Evening. Panzee had had an unhappy time with Chim who had treated her very roughly during most of the afternoon in their playroom. They had been left alone throughout the afternoon—a rare occurrence and deeply resented. Chim had vented his irritation upon Panzee by dragging her around the room and mauling her about for so long that she was completely exhausted. When taken up her body was shaken with emotion, and her lips trembled pitifully as she seemed to be trying to express herself in these sobbing words:



73

She continued this until she was put down in her place at the supper table where the warm food attracted her attention, and she gradually grew quiet.

CHIM EATING

The term *fruit motive* is applied to a group of purely tonal phrases which are thoroughly distinctive in character, and which were uttered by Chim and Panzee very frequently in connection with the eating of oranges, apples, and bananas. This fact appears to warrant the inference that they are significant, an opinion confirmed by the writer's observations of other (adult) chimpanzees at the Zoölogical Park in New York. (See Boma's records, nos. 286–290.)

These fruit motives are underscored to facilitate their recognition, and the food sounds are indicated by the word *gahk* or one of its variations.

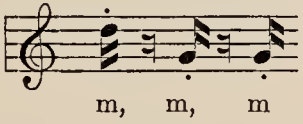
It may be well at this point to note that Chim and Panzee made occasional use of this type of phrase in connection with milk (see no. 148), either when anticipating it or while having

it at their meals. They also used it, on very rare occasions, while eating in the open—wild strawberry leaves and the tender bark of young birch twigs.

Morning. Fruit as usual was the last course of their breakfast. Apples were brought in and Chim uttered eagerly the following phrases:

74

Shortly after, a group of children appeared at the screen. Chim went over to see them but soon ran back to his swinging rope, murmuring this variation of his fruit motive.



75

He went on swinging with his head down, clutching the rope with his feet and one hand, and holding what was left of his apple in the other. The children were rather noisy in their appreciation of his acrobatic performance, which may have excited him. He swung too close to the floor and got a hard bump on his head at which he uttered this prolonged tone:

76

A little later D., his friend and playmate who romped and swung with him, went out, and he still used his fruit phrase to call to him, at first very slowly:

77

then very rapidly with a pronounced gliding of the tones (portamento):

78

and

79

Afternoon. While playing in the pasture, he ate wild strawberry vine, grass, and cinquefoil, using his fruit motive rather broadly:

80

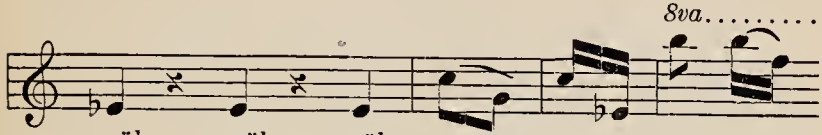
Chim always gave the impression of taking much satisfaction in his food when he used his food-word:

81

Panzee was very deliberate, but Chim ate much like a hungry little boy. He was trying to get some of Panzee's breakfast-food, after having finished his own, when he whined:

82

and when his fruit was brought he first said his food-word, then the fruit motive several times:

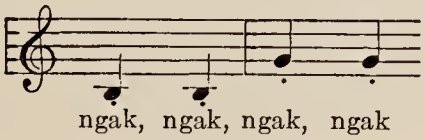


83

He was in the habit of biting off every scrap of the lining of the orange rind with his sharp teeth. This morning he whined very softly as he did so.

84

Morning. At breakfast, with much appreciation:



85

But when Dr. Y. took his bowl of food away, for spilling it, he apparently thought that it was lost to him forever, and protested vigorously with his piercing call:

After having finished his recovered bowl of breakfast-food, he begged for some of Panzee's, very softly and rapidly:

He was not allowed to have it, and flew into a passion. Jumping to the floor and crouching low he ran back and forth, the embodiment of fury, with his lips drawn, teeth showing, and screaming his loudest tones:

It was characteristic of Chim when angry to begin this scream without other utterance, and to stop as suddenly as he began. He then would seek immediate comfort by running to someone with outstretched arms to be taken up and forgiven, his lips pouting in a peculiarly appealing way. It was intolerable to Chim to bear the displeasure of anyone for whom he cared.

When the oranges were brought in, he expressed himself thus:

89

Morning. He alternated, rather steadily, *ghak* calls with whining phrases, the latter seeming at times, to express impatience, and at times, eagerness:

90

Dr. Y went out to get the accustomed fruit course. Both chimpanzees showed increased animation at once, fruit being their favorite food, and the type of utterance suddenly changed from the examples above to the fruit motive.

This is one of the most convincing groups of utterances in that it shows at least the chief meaning to Chim, of the fruit motive. When Dr. Y. had gone into the next room for the fruit, Chim began these sounds, continuing them when the fruit came:

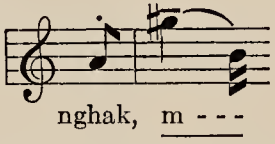
91

Morning. Chim was rather silent, occasionally whining his impatience for the next bite of breakfast, and following it by tones of satisfaction, *ngak*. Then more whining. There was one example of the fruit motive that may have been in anticipation:

92

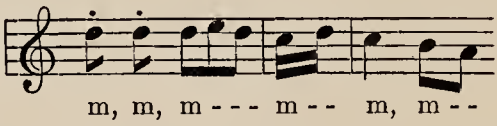
Morning. Chim had spent a solid hour in working on an experiment before breakfast. (See records nos. 34–51.)

When he finally got his oatmeal he uttered one expressive *ngak* and a single example of the fruit motive:



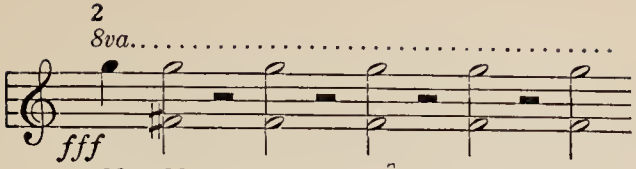
93

Then came these rather pathetic whining notes:



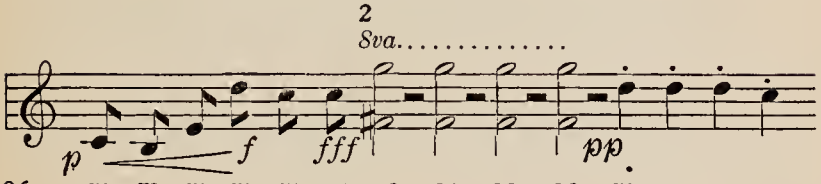
94

Evening. At supper he was much annoyed because he could not have Panzee's food. He screamed loudly:



95

Then he whined, and screamed again vigorously:



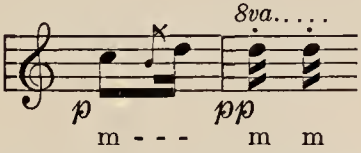
96

Morning. Chim was given his oatmeal before his experiment. These are his sounds of enjoyment while eating it:

97

(Compare with Boma's food-sounds, nos. 295–298.)

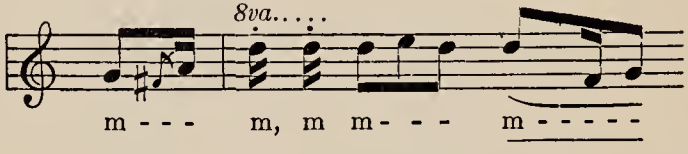
A long experiment ensued after which he was taken to the observation room where Panzee was eating the last of her breakfast, an orange. He apparently wanted it and begged for it softly:



98

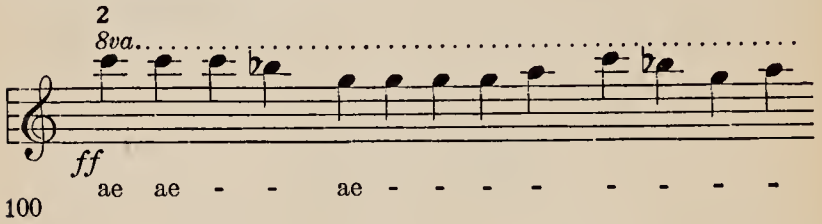
Panzee up to this time had been willing to give up almost anything to Chim, even the food which she held in her lower lip. It seems to be the custom of the jungle for the male

to have what he wishes. She made an exception of oranges, however, and Chim had to content himself with a bit of discarded peeling until his breakfast was brought. He went to the swing and played around whining again nearly the same appeal as before:



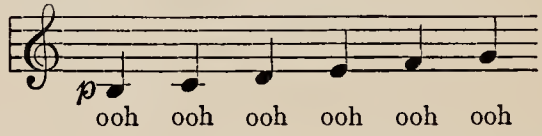
99

It was soon evident that he was not happy, and presently he began to scream his protest:



100

His milk was brought, and he ran to Miss M., uttering in beautiful tones these notes of a perfect scale:



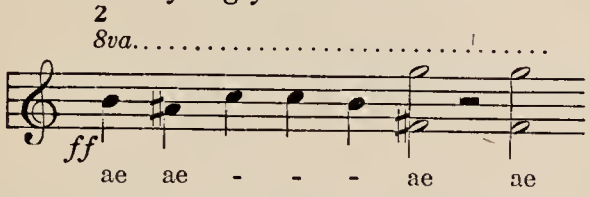
101

He drank some of his milk, but seemed too disturbed or annoyed to continue. He screamed loudly in double tones:

102

Then he paused a moment, and screamed again while running back and forth:

After another pause and a look around, he screamed more loudly. He was very angry indeed:



Finally he decided to come back and drink the milk. While drinking he choked. This was the last straw to his patience: he became furiously angry:

Then coughing:

and so forth.

At last he became quiet and pleading to make up he uttered this phrase very softly:

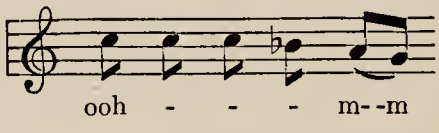
108

Then while chewing his orange skin:

109

Morning. Chim came through the experiment gallantly. He piled the boxes one upon the other, until he reached the banana suspended above him.

As his oatmeal was brought, he said:

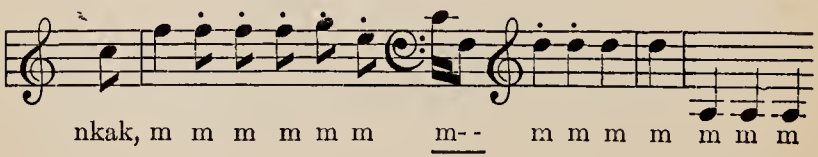


110

And a little later:

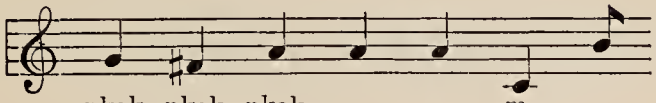
111

Morning. After the experiment he made these sounds while eating:



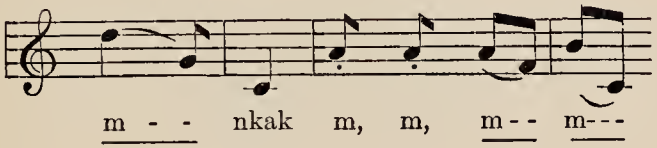
112

After eating his own, he stole Panzee's corn cake, and revelled in it, thus:



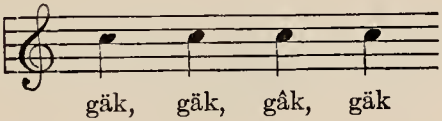
113

When it was time for the fruit to be brought in, three instances of the fruit motive were noted:



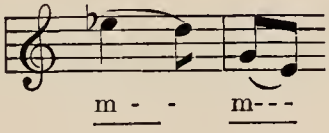
114

Morning. Breakfast again following the experiment. Chim expressed great satisfaction with his food: first it was:

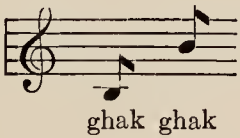


115

Then, while drinking his milk:



116

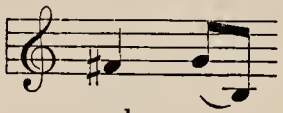


116a

And later while eating his orange and trying to take Panzee's as well:

117 ghak ghak m-------

These are the sounds that he uttered while chewing the bark of a birch stick. Note the food-word and a fruit motive:



118 ngak m---

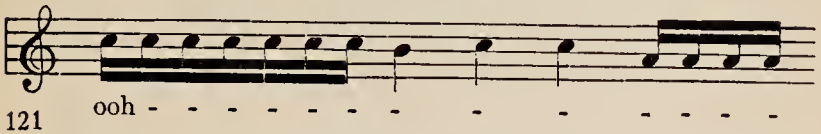
Evening. He lost his temper when he was refused Panzee's supper after having finished his own. First he whined:

119 m, m, m, m, m

Then he screamed long and vigorously:

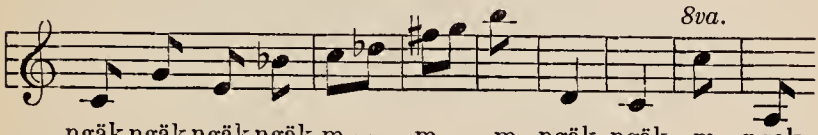
120

He stopped screaming suddenly, and ran to be taken up, uttering these pleading tones rapidly and very softly:



121

Morning. Chim ate his breakfast with much satisfaction using his food-word frequently:



122

Afternoon. As he returned from his outing, he spied a pear hanging in a young tree, and sprang to get it. He was told to come back but persisted in climbing the tree, uttering this fruit motive:

123

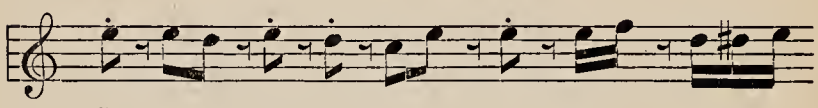
And afterward in his cage, while eating the pear, there was heard this significant *ngahk:*

124

Morning. Chim and Panzee sat at meal-time at their little box table upon seats attached at either end. They were fed alternately a spoonful at a time, being assisted to hold their spoons straight and to dip their breakfast-food from their bowls. Each held his own bowl in its place on the

table with his left hand, and waited his turn, which was not long in coming. During the first weeks Chim ate more rapidly than Panzee, and was given more turns; but this morning he was irritable with no apparent reason, and wanted all the attention, expressing his impatience in the following terms:

124a

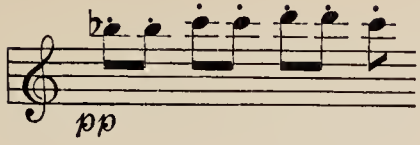


125

It was not considered good manners at breakfast to stand on the table; but Chim transgressed several times at Panzee's turn, and was firmly admonished, at which he jumped to the floor, and screaming his loud double tones, ran crouching back and forth:

126

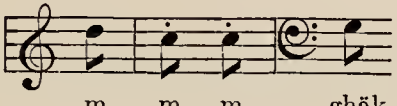
Panzee was allowed to go with Miss M. to the observation room but Chim was still screaming. Dr. Y. went out and closed the door. At this Chim's face, always expressive, was a study in incredulity. Here was something new, and he could scarcely believe that he had been left—and without breakfast! He turned his head from side to side, and uttered in a very small voice:



127

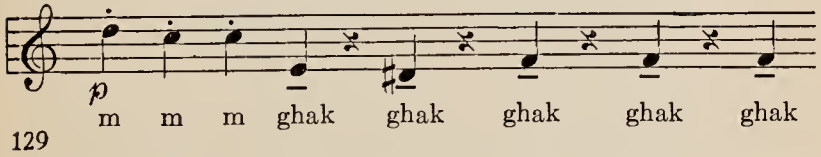
Coming in the midst of his screaming double tones, this furnishes a good example of the extremes of his varied powers of vocal expression.

He remained quiet and was soon taken to the observation room and given corn bread and fruit. He said only:



128

And when his master left the room a little later, his behavior was quite new. He seemed to be deeply impressed by the ban of displeasure under which he felt himself to be, and followed in a hesitating manner. When Dr. Y. turned around at the door, Chim stood up at a respectful distance, leaned forward, and made an eloquent gesture with his arms and hands. It seemed as though his mind and body united in a supreme effort to make himself understood. To all appearances he was trying hard to speak as he uttered the following sounds; the first three a pleading whine, the others his own word *ghak*, repeated with conversational inflections:



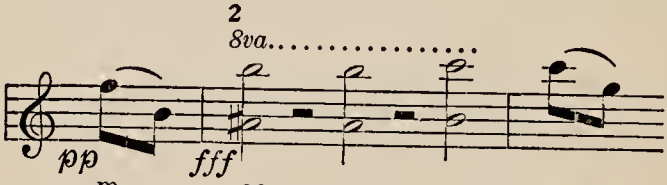
129

Dr. Y. went out, and Chim returned in a very subdued man-

ner, picked up his corn bread, and repeated again in very low tones his food-word:

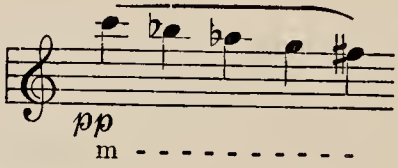
130

That evening he uttered in quick succession, his fruit motive, his loud double-toned yell (in joyous anticipation of the food that was being placed on the table), and another fruit motive:



131

Then during supper came this beautiful phrase—deliberate and very legato; from a musical standpoint, a fine expression of longing:



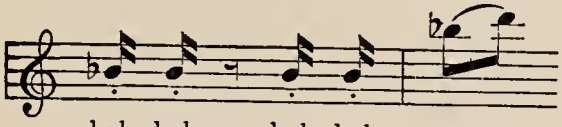
132

And later these tones:

133

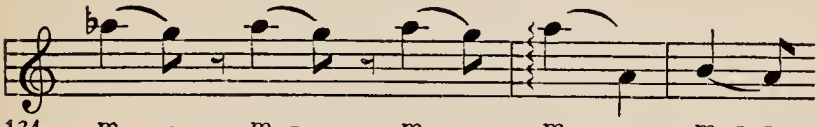
The next morning Chim's manner was very subdued. He had an excellent memory for a little fellow but a year

and a half old, beyond that of a human child of that age, and seemed to be feeling unhappy because of his master's displeasure the evening before. He had slipped by as we were leaving him after supper, and had made a dash for the green apple trees, whose branches overhung a stone wall near by. There had followed an exciting chase (see no. 184 with text), in which a formidable looking stick had been used with considerable strategy before he was recovered. At breakfast, his friend D. was feeding him, but he kept looking toward Dr. Y. while he ate, saying *kah—kah, kah—kah* almost in a whisper:



134 kah - kah, kah - kah. m - - -

Then when waiting for milk:

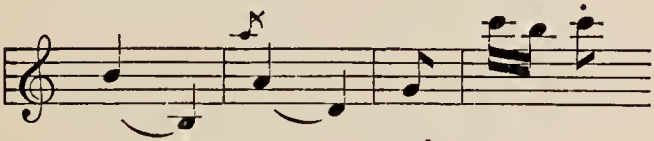


134a m - - m - - m - - m - - - , m - -

And later as D. took him up, he squealed:

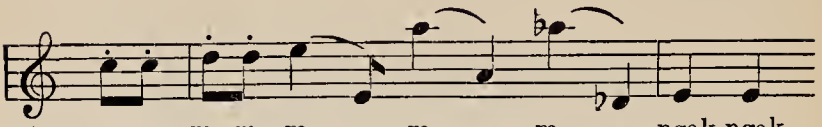
135 ae - - ae - - ngak

Evening, while eating:

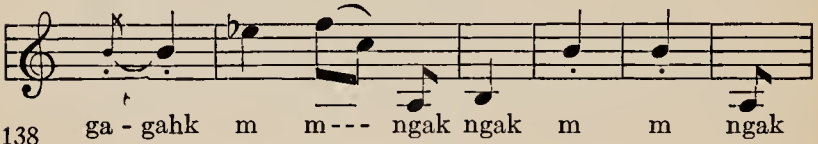


136 m - - - mmm - - - ngak m - - - -

And another evening:



Morning. Eating, and drinking milk:



Evening. While eating banana and orange, Chim gave several repetitions of the phrase for fruit and juicy foods:

Morning. While eating and drinking:

This morning Chim talked a great deal about his food:

Evening. As they climbed into their nests of hay, eating the last of their bananas, Chim uttered these attractive phrases:

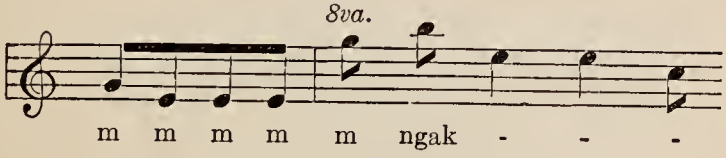
142

Morning. Chim was never more interesting at breakfast-time than on this occasion. While waiting for the orange-juice to be brought in, he stepped up on the table and waved his arms and hands in eager anticipation. He looked a veritable pickaninny in his liveliest of antics as he danced and tilted from one foot to the other, flinging his hands and his free foot in a curious way peculiar to himself and indicative of wrists and ankles of unusual suppleness.

He uttered but one phrase as he ate:

143

In the evening he had more to say while he was eating the main part of his supper:



144

And when he was given banana, this: (Note the similarity

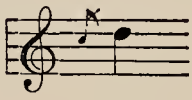
to Boma's utterance when calling for his meal of bananas, apples, and oranges. Nos. 290, 295.

145

The next morning he had this to say:

146

Another morning, when food arrived, he whined:



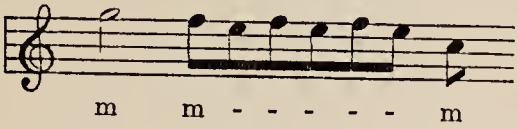
147

And when a cup of milk was given him, he responded with two phrases like the fruit motive. This was one of the rare occasions when Chim used this expression in connection with food other than fruit. (See also no. 80.)

148

Evening. He was very lively. A child came to the screen

with a large bunch of fresh carrots, and he whined an animated new motive:



149

Then followed the food-word, many times repeated, and a variation of the first phrase with the trill, lower in pitch:

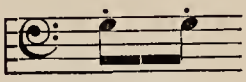
PANZEE EATING

Panzee, a really beautiful vocalist, was usually silent at the table. She was in rather delicate condition at first and had not much interest in food. She was in the habit of retiring to her nest, which involved a climb, between courses or when the feeding was stopped for any reason, even for a moment.

She, too, uttered a typical phrase of distinctive quality and use in connection with fruits:

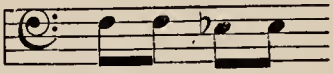
152

Morning. Panzee was silent except when the milk, of which she was very fond, was brought; then she murmured:



153 ooh ooh

And when the oranges came, she ventured these tones, all of a fine musical quality:



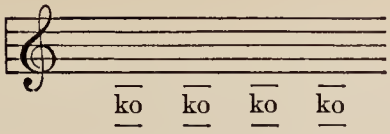
154 ooh - - -

The next day, while eating an apple, she uttered these tones with *kha*, which seemed to be a variant of her food-word. (See no. 9.)

155 kha - - kha -

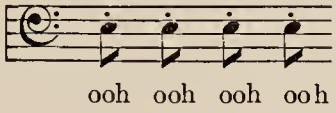
Morning. She was unusually animated, eating alone after having had oatmeal with Chim. He was having an experiment, and she, always keen and sensitive to what happened to him, may have felt a certain tension in the air which was often perceptible when Chim's intelligence was being tested. For the first time, also, he was making some noise as he piled up boxes in order to reach a banana suspended above him. Occasional thumps could be heard as the boxes came down, which may have affected her.

She looked as though she were talking, as she said very rapidly and in an emphatic whisper, when a half-orange was given to her:



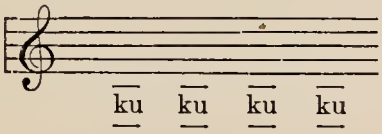
156

Then, as she ate, she uttered these tones:



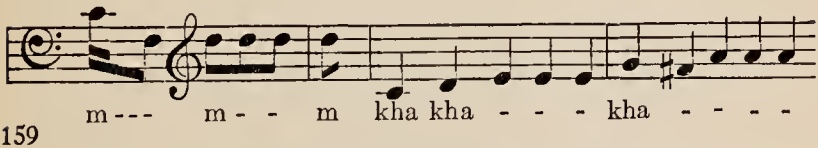
157

And when another half-orange was given her she whispered again emphatically, changing the vowel to short u:



158

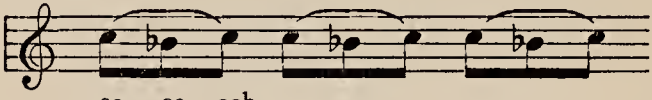
Morning. It was quite evident that fine care, good food, and long hours spent in the sunshine and fresh air were having their effect on Panzee. She was energetic and talked with much satisfaction of her breakfast, using her variant of the food-word, *kha*. When her milk was brought, also the fruit motive:



159

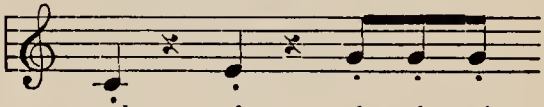
In the evening she was very lively; in fact she climbed on the table, and tried to get Chim's supper—an unprecedented

act on her part. As she reached for his milk, there came this new motive:



160

And later this:



161

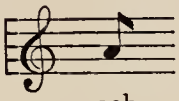
CHAPTER III

Sounds Associated with Other Creatures

chim's behavior with people

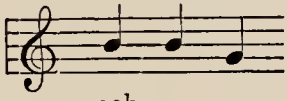
As has already been seen Chim was naturally friendly. He enjoyed being held when not engaged in something more interesting, and greatly disliked to have his human friends leave him.

His appeal on one such an occasion was a single *ooh* as follows:



162

Another time, as they were being left for the night, Chim begged:

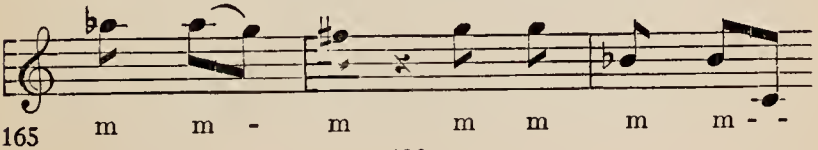


163

And tried to slip by, insisting with these persuasive tones that are distinctive enough to be called a *coaxing motive:*

164

He struggled to get through, expressing himself thus:



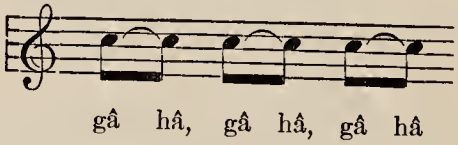
165

But was held back, and screamed in anger:

After a self-pitying whine, he ran to the screen door, and screamed shrilly once more; then he whined softly as we went away:

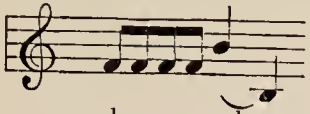
Chim tore his blanket and was scolded. He answered with these two tones.

A garage mechanic, whose face and hands and clothing were somewhat blackened, appeared at the screen. Chim was much interested. After looking at him intently for a moment, he said *ga-ha, ga-ha* in a rather conversational manner as though he were being understood:



While playing under the birches he observed some friends

of the family approaching in the distance, and uttered the following with a welcome that was most hospitable:



170

A little later in the afternoon another friend came, and received this greeting:

171

Both chimpanzees were inquisitive, Chim particularly was an accomplished pick-pocket. He seemed to possess an acute instinctive stealth without being sly. His approach to one's pocket was merely the intelligent working out of a definite purpose to find what was hidden behind the fold. He examined quite as carefully a plait or the turn of a collar or cuff before he learned that only certain folds held interesting things. When discovered he was not at all discomfited, but continued his search with a funny little change of expression in his features that seemed to say "I have your permission?"

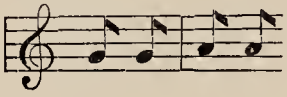
His handling of clothing was so delicate as to be almost imperceptible to the wearer. He would reach into a pocket and grasp whatever was there—handkerchief, pencils, or pitch-pipe—between the fingers held straight. His fingers are larger and longer in proportion to the hand than those of a child. Pencils he would split in pieces with his teeth, and he liked to chew the eraser.

Chim's manner of carrying objects that he found, or that

he purloined from his friends, is noted in the text following No. 188.

Chim played frequently with rope and swing, and was delighted to have D. join him in a grand romp. If D.'s attention were occupied, Chim would stamp on the floor, in an engaging manner difficult to resist.

Upon one occasion, he uttered the following when thus encouraging D. to play:

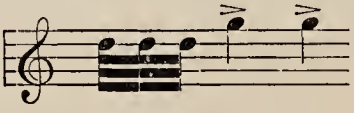


172

When D. was walking about in the yard and Chim was indoors, the latter showed his eagerness by alternately looking intently in D.'s direction and then restlessly moving around, while he expressed his desire in these pleading phrases:

173

Miss M. appeared in the yard, and he uttered this martial motive—an amusing reminiscence of the Marseillaise:

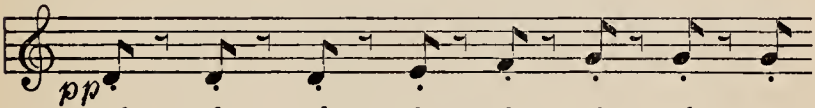


174

Chim made friends with Mr. E. and took it upon himself to look through his hair in a very thorough fashion, going over a considerable portion of the top of his head where there was no hair, quite as thoroughly. At last he reached his ears, and no mother ever peered more searchingly behind the ears of her young son than did Chim; in fact his expressive face took on a problematic look at this point, which amused the two or three onlookers very much. He was silent during the episode with the exception of the following phrase:

175 m - -

Chim was not above being carried, although he was strong and healthy. This day he preferred it, and when put down, he pleaded with this beautiful soft phrase:



176 ooh ooh ooh ooh ooh ooh ooh ooh

Then realizing the full measure of his grievance (Panzee was being carried) he screamed:

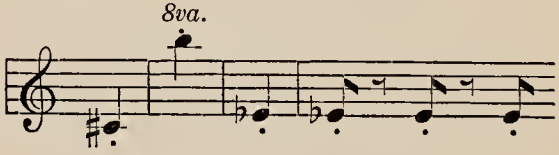
177 ae ae ae

He stopped a moment to cast a sharp look at us, then screamed again, spun around, tumbled, and somersaulted in his fury. This behavior he continued for some time, paus-

ing occasionally to look at us. He crouched very close to the ground during the whole performance.

Chim discovered that there were large green apples just over the stone wall near the observation room. If he had an opportunity to run away he usually made his escape in that direction. His procedure was to climb the tree to a point beyond our reach, take an apple in each hand, and lose no time in eating both. He seldom failed to manage it before he was caught.

One morning he got away and cried excitedly as he ran toward the trees:

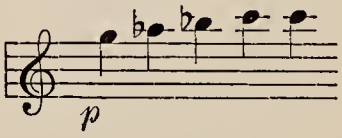


178

He was hotly chased by D. and screamed shrilly:

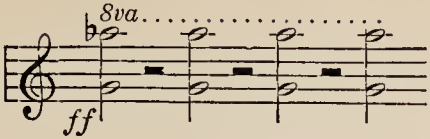
179

Then he whined softly as he ran looking for a loop-hole through which to escape:



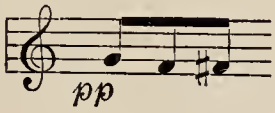
180

He was nearly cornered, and yelled again:



181

He almost got away:



182

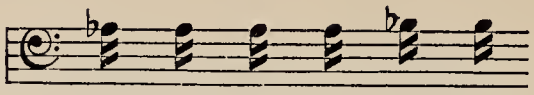
but finally after an exciting race, was caught and taken back:

183

On another day he ran away, and was chased with a big stick, which whacked formidably upon the ground. He crouched as he ran back and forth, not seeking to escape but *facing* the danger, and shrieking in very loud tones this rhythmic variation of his scream, many times repeated.

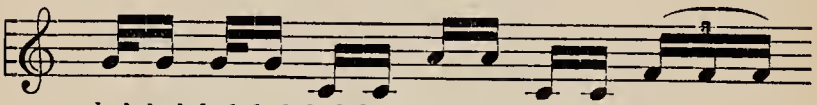
184

When shaken gently with the hand on his chest Chim would laugh audibly, sometimes using the word *kah hah* with the mouth wide open, and in regular rhythm, the pitch changing but slightly:



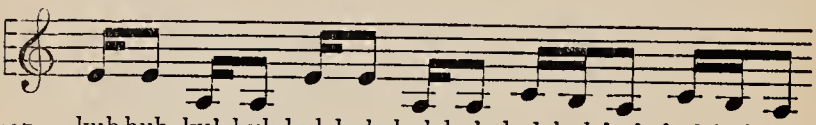
185 kah hah kah hah kah hah

Then leaping a fifth, sixth, and fourth, up and down the scale, his laughter became heartier:



186 kah hah kah hah kah hah kah hah kah hah kah ha ha

At another time with his mouth slightly open, he laughed with the word *kŭh-hŭh,* breaking the rhythm in the last two phrases, as it became heartier, but without changing the meter:



187 kuh huh, kuh huh, kuh huh, kuh huh, kuh huh huh, kuh huh huh

And again, this very rapid utterance, with a pause at the bar line where rhythm and meter change:

kuh huh, kuh huh, kuh huh, kuh huh,

188 kuh huh huh, kuh huh huh, kuh huh huh

(For records of spontaneous laughter see nos. 239–241.)

Chim enjoyed running away with the small belongings of those about him. This seemed to be due partly to a desire

to satisfy his curiosity undisturbed, and partly to his love of the chase that invariably ensued.

He particularly liked to tear and chew the leaves of a note book; and he stole a No. 2 Brownie kodak in an unguarded moment, placed it in his groin, and climbed a tree with it in that position! Upon reaching a secure height he examined it, and discovered the small strap handle; seizing this in his mouth, he climbed further with his treasure, while David, the owner—who was no mean climber of the birches himself—went up after him.

He would carry a tennis ball in his groin for some time with no apparent effort, while he played and ran about as usual. His most ambitious attempt to carry things in this fashion, was with a pile of stones which he found on one of the ledges, and undertook to remove to the turf. Three or four of these he could carry in his groin, with the aid of one hand, very comfortably; but not content with so few, he added to them a fifth, and a sixth, and even a seventh until, when he moved, one or more were bound to fall. As these were recovered, others slipped down; and the persistent little fellow labored intently for fully thirty minutes over the problem of carrying all of the stones with which he started. At last, by dint of losing them always in the right direction, he accomplished his purpose.

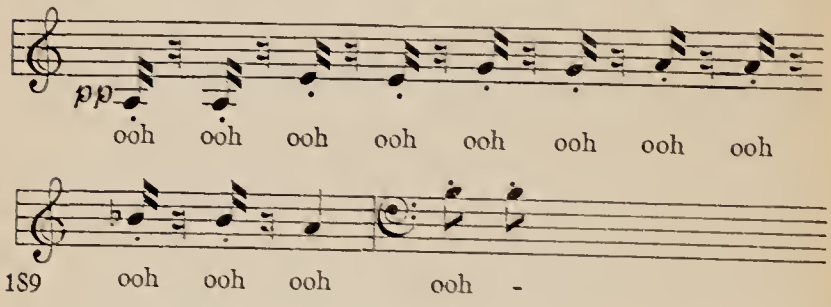
PANZEE'S BEHAVIOR WITH PEOPLE

During the early part of Panzee's life at Franklin she was very timid. This was due in part to her physical condition and in part no doubt to the strange people and surroundings. She was, however, very friendly and affectionate with those whom she trusted, and was particularly loyal to her master and Miss M. She exhibited her affection for people

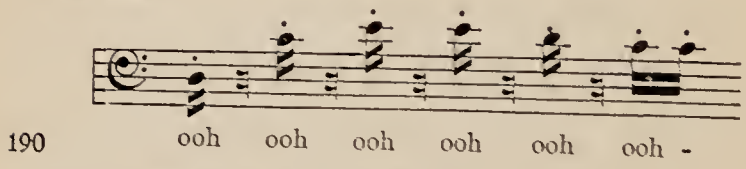
at times by sitting on the floor by one's chair and gently taking one's hand; rarely, by holding it to her lips for a moment, as though kissing it.

She and Chim were taken into the open for air and sunshine every fair day, and were often carried to and from their play ground where Chim ventured some distance from us to climb the young birches. Panzee, however, wished to be held, or at least to sit quite near to someone, seeming to be fearful of the out-of-doors.

To encourage her to climb, for she was much in need of exercise, she was placed on a low branch of a tree, from which modest height she protested with this charming phrase, whose structure, as well as the quality of its tones, was very lovely:

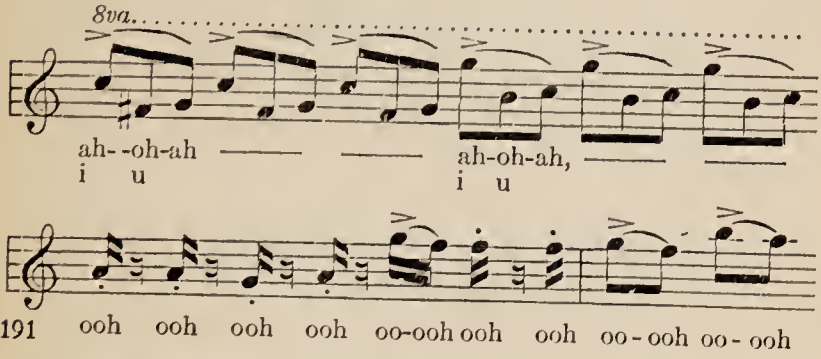


On another day, when placed on the stone fence, she made this appeal:



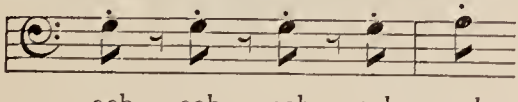
For the sake of exercise, when going for their outing one day, she was not taken up as usual. An energetic expression of disapproval came at once, in a new type of utterance, in

which the tones were slurred, although definite and clear, in contrast to her usual staccato *ooh*. The vowel sounds were blended, *ah* with *i* and *o* with *u* as indicated; and *ah-o-ah* was not a sequence of three separate syllables, but rather one syllable sounding through the changing aperture of her lips, as she widened and pursed them in this half scream, followed by a staccato phrase:

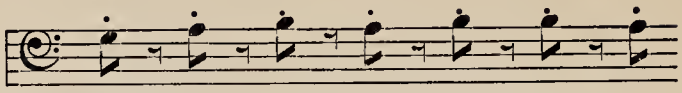


She lagged behind, continuing her protest in the emphatic passage below. Notice the rapid repetition of the staccato tones, followed by the vigorous, accented phrase of two slurred notes, repeated twice, and the two very high tones of her scream—a vivid picture of the state of her mind.

Another day, upon finding that she was not to be carried, she set out timidly to walk, expressing her feelings in these halting tones:

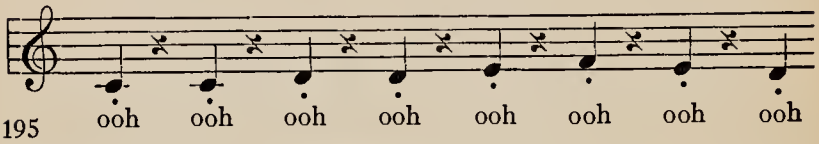


A pause, and then these:



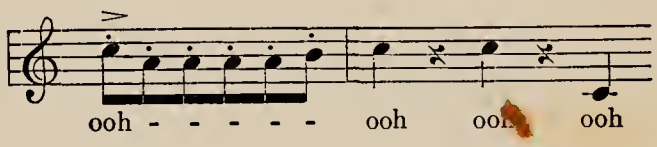
194

Another pause, then picking her way cautiously:



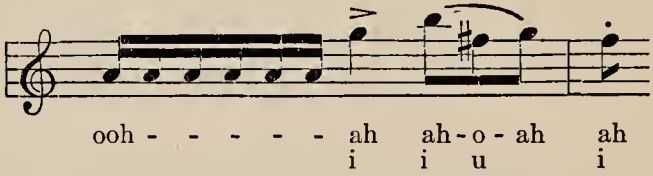
195

She became a little frightened, and looked about apprehensively:



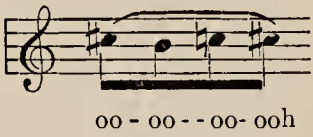
196

Becoming more excited she demanded, with this animated phrase, to be taken up:



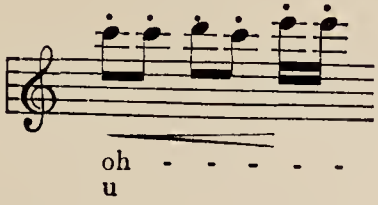
197

She was reasoned with, and went on a little further singing plaintively:



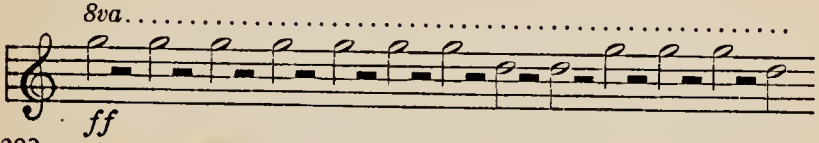
198

Then, seeming to lose her courage completely, she raised her tones suddenly in pitch, and increased their volume and rapidity thus:



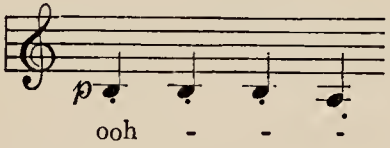
199

until she burst into this loud scream, with mouth wide open and teeth showing:



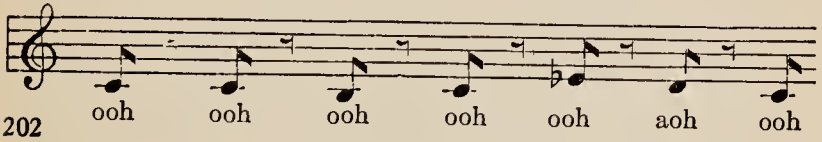
200 ae ae ae ae ae ae ae ae ae ae ae ae ae

Our slow procession halted a few moments and she grew quiet. Then going on she carefully chose her steps over occasional briars and hummocks, portraying the scene delightfully in these isolated groups of beautiful tones.



201

Pause:

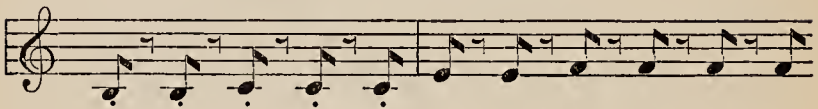


202

Pause:

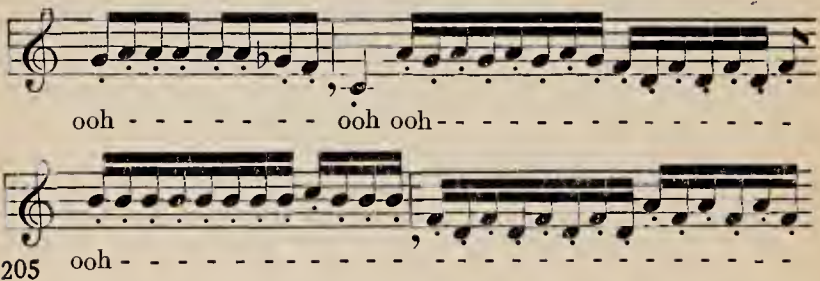
203

A short pause, and these two similar phrases:



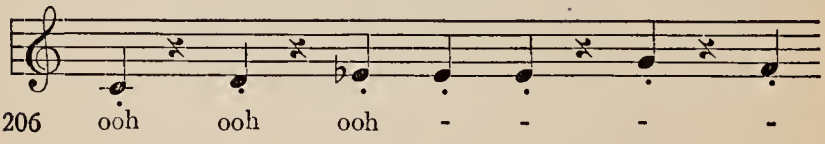
204

Another day, on going for her outing, she expressed her protest against walking in a display of vocal technic worthy of a finished colorature singer. The tones were rapid and of exquisite quality—a delicate staccato. The bar lines indicate pauses, which were short in this record:



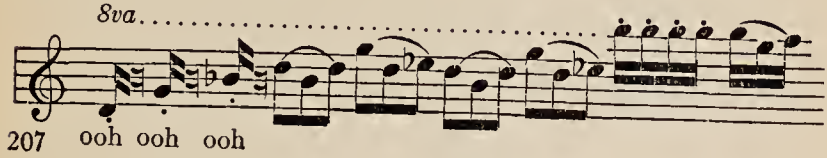
205

Then came a phrase which contrasts completely with the foregoing highly embellished utterance. It was slow and of fine poetic quality:

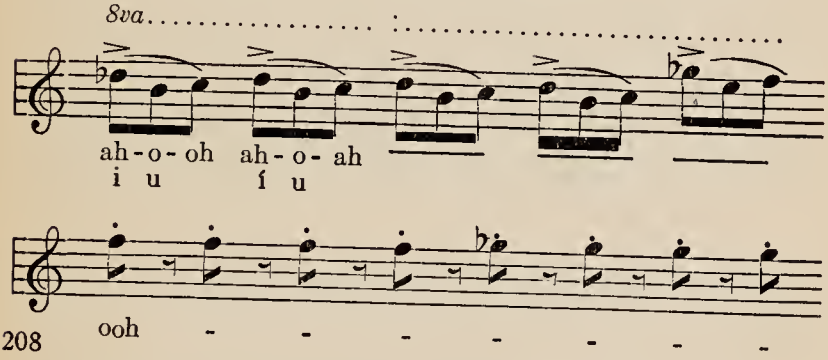


206

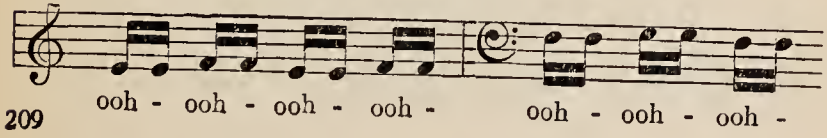
But her patience gave out, and there followed this lively pronouncement:



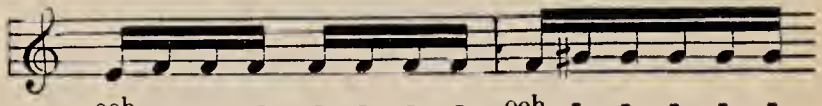
On her way home from her outing, she seemed unusually apprehensive and begged to be taken up. The slurred phrases were always the superlative expression of appeal, or fear—which was probably her feeling on this occasion:



Returning home on another morning, Panzee looked about her fearfully, as though afraid that the great out-of-doors might catch her, and begged to be carried. When no attention was paid to her request, she clutched the dress of her good friend, Miss M., firmly with both hands and feet, uttering these tones softly as she climbed to her arms:

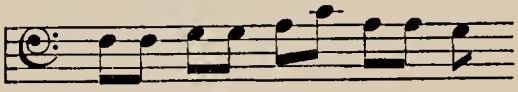


Being put down she protested thus:



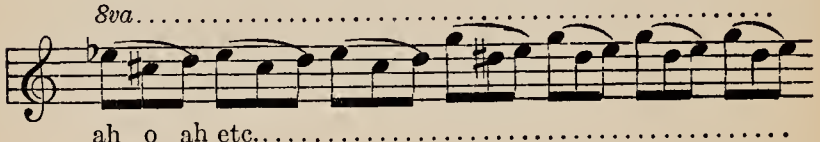
210

Again, after her outing, she wanted to be carried, and climbed by way of Miss M.'s dress, uttering these tones:



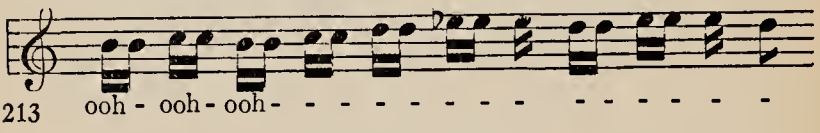
211

She was promptly put down, and shrieked her despair:



212

But with renewed determination she climbed up again, expressing her feelings in this attractive phrase:



213

Two children came frequently to look at the chimpanzees at the screened end of their room. They always came as though fearing to be discovered, and Panzee seemed to dislike it. She would stalk by them, the full width of the screen, some twelve or fifteen feet, with her head in the air and her steps emphasized in a manner that seemed to say, "These are not to my liking."

A certain reserve and gentle dignity of manner, as well as a fastidiousness of personality, characteristic of both creatures, suggests that Panzee is of a patrician race.

This quality is perhaps more scientifically shown in Chim by the unusually fine lines of his face and head.

Panzee showed her friendliness for people, when they approached her vicinity, by her facial expression and by asking to be taken. She sometimes expressed an audible greeting, when especially stimulated.

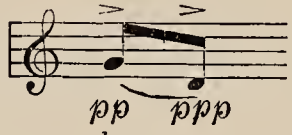
One morning they had been taken to Dr. Y.'s house for some special experiments with Chim. Afterwards, in the presence of a considerable number of people, Chim was dancing with the young people to the music of a victrola. He did this with evident enjoyment and with perfect rhythm. Whether or not he was conscious of keeping step with the music was difficult to know; he at least kept step with the girl who held his hands, and moved with apparent ease and with a distinct grace.

Meanwhile Panzee, because of her nervous condition, sat safely on Miss M.'s knee by the fire-place, somewhat aloof from the confusion. She was, however, a most interested observer of what took place, especially in what concerned Chim.

In the midst of this merriment a friend, whom she had not seen since the day before, came in, and she barked loudly twice in recognition. The two tones of her bark were sounded simultaneously as indicated on the staff:

214

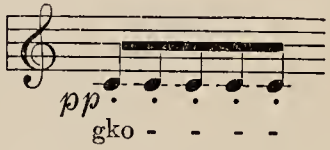
On another morning, Panzee had been uttering notes of warning with her word *ho*, because of a chugging auto that stood some yards away, and caused her great concern. As a guest of the house approached the screen from the outside, Panzee came forward and greeted her, as though trying to tell her of the fearsome thing, and used the same tones of warning with the peculiarly aspirated *ho*. (See nos. 266–275.)



215

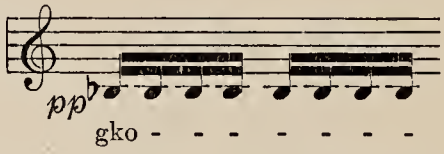
To greet her friends, she used most frequently her word *gko*, or one of its variants. The g and k are blended and have no equivalent in English.

On the same morning she welcomed a visitor with this tone softly repeated five times:



216

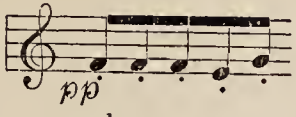
And a little later, when one of her men friends approached (she was partial to men), she used the same type of phrase more rapidly:



217

When pleading, at which both she and Chim were adept, they used *ooh*. As they were being left for the night, Panzee

begged Miss M., with the softest, sweetest possible tones, to stay:

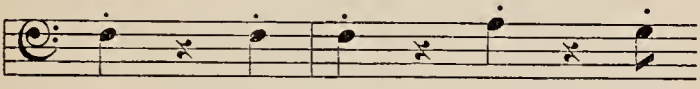


218

On another evening, as hay was being put in their sleeping place, she uttered these low tones approvingly:

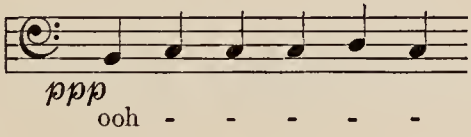
219

She evidently appreciated the hay, and continued:



220

Then, as Chim climbed in and both were still eating their corn-bread—the last of their supper—she uttered her lowest recorded tones. (This "small" *c* is the low tone of the common range for tenor voices.) The tones were very soft—a mere breath:



221

On another evening this was Panzee's "good-night":

222

BEHAVIOR TOGETHER

There seemed to exist a genuine family feeling between Chim and Panzee which was manifested in his attitude of protection toward her in times of danger. Then it was his habit to place himself between her and the danger that threatened. If this were intangible, or not clearly understood, of if she alone were frightened, he would put his arms around her and stay with her until the anxiety had passed.

Panzee showed her loyalty and affection for Chim in several ways. She was willing to give up things to him, even the food which she held in her lower lip, with a few reservations such as her orange or banana; she was anxious when she thought Chim was not well treated; and she forgave him immediately, when he pulled her fur and mauled her about, making efforts to conciliate him. Her motive at such times may have been partly to keep peace. She gave the impression of being an astute little creature, very quiet, but with a keen discernment of things within her mental range.

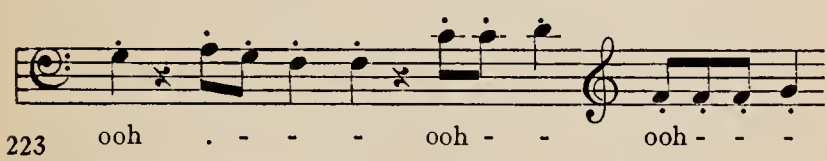
The habit of looking through fur and scrutinizing the skin for any unevenness was always taken seriously, although these chimpanzees were wholly clean. The impression came to the writer that the habit was partially social in its significance. Chim went about it in a business-like fashion, and made a curious liquid sound with his lower lip against his teeth, *vts*, *vts*, *vts*, when he found even an infinitesimal roughness. During his search he moved his lower jaw from side to side, much as an animal that chews its cud.

On one occasion he held Panzee's head firmly between his hands, pressing down so hard that she must have been very uncomfortable, but she seemed to enjoy it and was gratified by this attention.

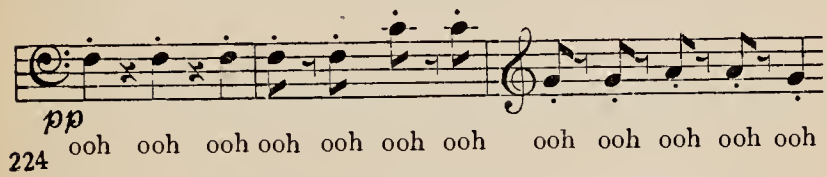
Chim sat one morning on a small box, with Panzee seated on the floor beside him. He reached down one of his legs to be looked over, and she complied with an air of complete content.

He was quiet for some time, but finally grew tired, and began to play and tease her with some irritation, as though bored with her contentment.

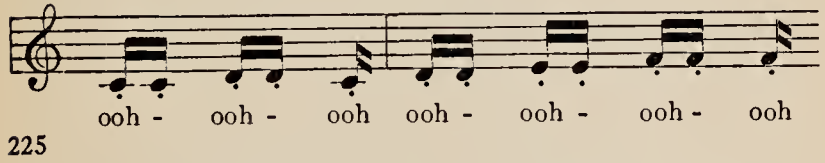
There was increase of animation in her utterance with rise in pitch:



On another occasion he seemed irritated, and came from the swing to pull her around roughly. She protested softly with a beautiful quality of tone:



Again he approached her with a menacing look on his face, and she ran for protection, murmuring:

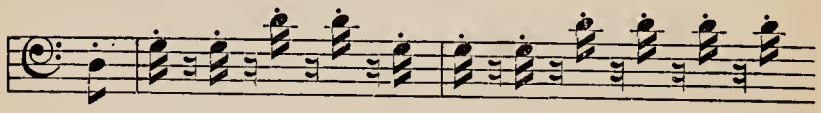


Chim's superabundant energy overflowed toward Panzee in an energetic attempt to stir her up. He took a hand-full of her long fur, and twisted and pulled it, in the meantime swing-

ing his arm from side to side vigorously. She uttered a new sound, distinctly of pain—short *u* fused with *e*, and *h*. But Chim had gone too far for even Panzee's patience. She angrily showed her teeth, and struck and bit at him several times, but soon fled for protection. This was her cry:

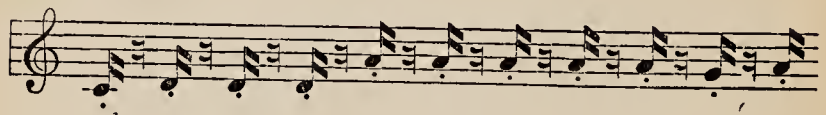
226

In the morning before leaving their sleeping room, Panzee sometimes sat on the edge of the manger in which they slept in their nest of hay. Chim ran about the room and enjoyed swinging on his rope or looking out of the screen door. This morning he disapproved of her aloofness, and ran every few minutes to pull at her feet, but she refused to come down. These were her cries of protest, lovely in quality as always:



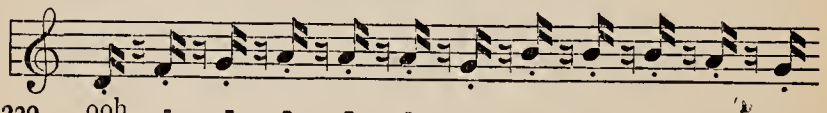
227

Again these:



228

And again, in a very determined manner:



229

As the play continued, Panzee scolded daintily from her perch on the manger:

Again:

And again:

Chim enjoyed his cocoanut oil rub greatly, but was less willing to have his hands and face washed with water. He usually demurred at first, as any healthy small boy might, but after giving up he lay in Miss M.'s lap contentedly while being oiled and brushed; in fact he used the brush on his head quite skillfully himself.

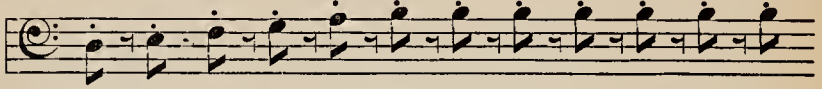
Panzee usually objected to being disturbed, often going to the farther end of the room to avoid it. If Miss M. told Chim to fetch her, he did so promptly and efficiently. He would drag her until she was well started, then would give her a little push to urge her along. She would permit the washing after some persuasion, but was distressed if any drops of water fell on the hair of her wrists. She would re-

move them carefully with her tongue before she allowed the washing to proceed.

D., a twelve-year-old boy, was Chim's most devoted playfellow, and Chim seemed especially to enjoy their romps together. Panzee tolerated their play, but now and then grew anxious for Chim. One day thinking D. too rough, she reached out as he came near her, and objected:

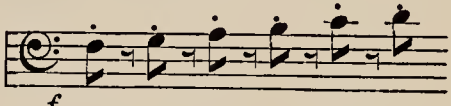
233 ooh - - -

Then, as the play grew noisier, she uttered these notes of the scale in tones that were vivid with active, emotional quality:



234 ooh ooh ooh ooh ooh ooh ooh ooh ooh ooh ooh ooh

And again a similar phrase, higher in pitch and more intense:



235 *f* ooh ooh ooh ooh ooh ooh

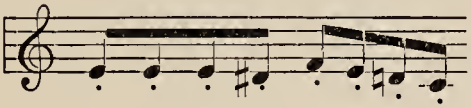
On another occasion she expressed her displeasure more mildly with tones that sounded like the soft beat of kettle-drums:

236 ooh ooh ooh ooh

On another day Chim and D. played still more energetically, swinging on the ropes, jumping on the floor, and chasing each other about. In all their sport Chim was quick to imitate any new stunts. D.'s bantering seemed to trouble Panzee greatly. She struck at him whenever she could, and uttered the following tones loudly and deliberately as she tried to reach him:

237 ooh ooh ooh - - ooh ooh ooh ooh ooh ooh ooh ooh

On a morning when the chimpanzees were alone Chim sat at the opposite end of the room, and Panzee ran to him uttering the phrase below. This is the only instance noted of her greeting him entirely on her own initiative, without some evident cause.



ooh ooh ooh ooh - - - -

238

Play

The pasture was the scene of the chimpanzees' activities in the open. Their trips to and fro gave us some of our finest records.

A good-sized, irregular hill-top spreads out into several fields, divided by stone walls and rail fences. Dotted over it are frequent clumps of young birch trees; and here and there great stone ledges, characteristic of the foot-hills of the White Mountains, emerge from the turf. A birch bordered

lane leads down through the hollow at one side to bars, beyond which, in the lower pasture, a herd of cows grazes in summer. This pasture encircles the fields on top of the hill; consequently the cows in their wanderings frequently came into full view of the chimpanzees at several points in their play-grounds.

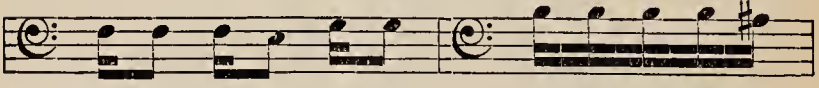
There was a sand hole on a slope of the hill where Chim spent many hours amusing himself, while Panzee sat near by. Above it projected a miniature cliff, from which Chim delighted to jump or tumble to the open sand in as many ways as he could devise. A favorite plan was to turn heels over head, over the edge; if the edge fell in with his weight, so much the better; he would pick himself up and race around to repeat the proceeding, often with spontaneous laughter. On one occasion these tones were as follows:

239 kha-hah, kha-hah, kha-hah, kha-hah, kha-hah, kha-hah, kha -hah

And again:

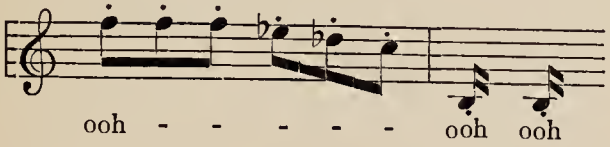
240 kha-hah kha-hah kha-hah kha-hah - kha-hah kha-hah

On another occasion:



241 kha-hah kha-hah kha-hah kha-hah-kha-hah-hah

Panzee sat in the sunshine with a look of benignant calm on her face; she was usually contented when Chim was happily engaged. Suddenly he dashed upon her, and dragging her bodily to the edge of the sand, pushed her in. She uttered this musical protest:



Chim could be quiet, and often was so; but he was worthy of close observation at such a time. His face was likely to take on a sudden look of purpose that was as suddenly put into action.

On one occasion he had been sitting for a few moments looking fixedly toward a rise in the ground a few yards away. It was a familiar spot where grew some isolated bunches of early golden-rod, three or four tall stalks in each bunch. Suddenly he dashed toward them, galloping so rapidly with his peculiarly irregular gait that he almost lost his balance. On reaching the plants, he broke off a tall bunch with one quick motion of the hand, placed it in his mouth, and galloped back, laying it neatly on the ground where we, with Panzee, sat looking on. This he repeated a number of times, finally biting the stalks off directly with his teeth and holding them firmly in the same horizontal position as he returned—an improvement in technique worthy of note in so young a primate.

On another morning we had gone to a more distant field where the scene was new to the chimpanzees. The ledges converged in such a way as to form a considerable depression, and Panzee was lying beside Miss M. enjoying the sunshine.

Miss M. also reclined, and Chim found great sport in running from behind, some ten or fifteen feet, and jumping over her to where Panzee lay. He gauged the distance so nicely as not to touch Miss M. nor quite to jump on Panzee, but so nearly did he come to doing so that he kept us in suspense during many repetitions of the performance.

While they were playing in the sand one afternoon, Chim observed D. disposing of something distasteful that he had got in his mouth, and tried to imitate him. He was not very successful, having difficulty in controlling the saliva, which annoyed him by gathering on his chin. Next morning, after Chim had been silent for some time in the back of the room, a soft sound—*php, php, php*—attracted the attention, and he was discovered very much engrossed in ejecting, at regular intervals, the tiniest possible spray of saliva, with an aplomb indicating that D. would not be able to outdo him with that stunt again.

Another of his lesser accomplishments was that of catching flies. He would curve his right hand and fingers, and with a swift motion from right to left, would almost always succeed in catching them in his palm. He seemed right handed.

One afternoon three children were playing leap-frog in the lane, while Chim and Panzee were sitting with older people some distance away. Chim watched the children intently, for a few moments, then with a rush joined their game, leaping from back to back to the end of the line and back again without touching the ground. He liked this so well that he repeated it several times, while the children obligingly held their positions.

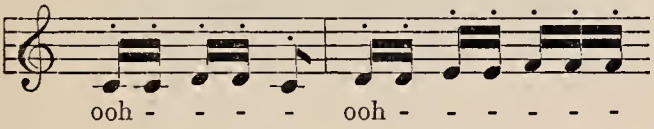
Chim was a skilled rider of the birches. He would climb a tree with consummate grace to the highest point at which it would bear his weight. There he would plunge over, carry-

ing the top with him to a comfortable swinging distance from the ground, and would swing back and forth, or round and round, with head down, or in any other position that might please him, finally leaping to the ground. Then he would choose another tree, gauging the right length of top necessary to swing him to still another. It was a sight as beautiful in its freedom of movement, as it was rare to our eyes, but during those weeks it occurred almost daily, and often many times a day.

Chim was in a particularly lively mood and ran to Panzee in his play to pull her fur. She responded with this appeal:

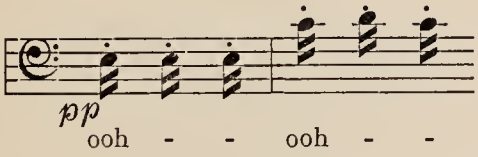
243

Again he came, and she ran for protection:



244

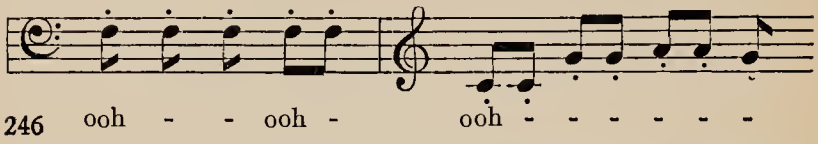
Then he swung down on the branch of a birch, and jumped on her; at this she uttered very rapidly:

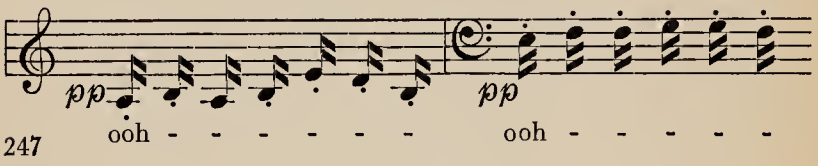


245

This performance was kept up at brief intervals for some time.

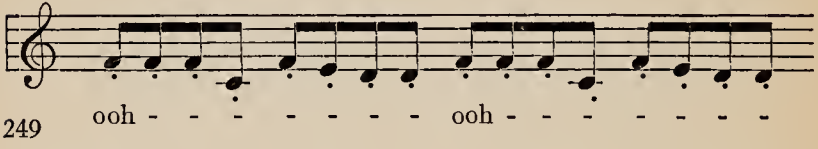
Panzee responding with these short pronouncements:





Then he bit her hand, and she screamed in pain:

As he continued his play, she expressed her emotions in this very distinctive phrase repeated



and this:

On another occasion she was furious with him for pulling her fur, and barked at him:

Then she tried to conciliate him:

252 ooh - -

He persisted still more aggressively, whereat she defended herself vigorously, swinging her right arm at full length to strike him. A genuine fist fight developed during which she barked loudly:

253 ka ka

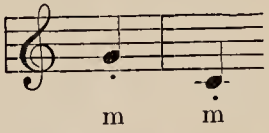
Chim's most striking activity was his so called "nest building." He went at it most industriously, with an assurance that indicated long practice in his ancestral experience, and possibly some observation during his own short life.

His procedure was to climb a tree to a certain height, usually two-thirds of the way to the top, and select a limb whose branches intersected rather closely, and around which other branches were numerous. He used little time, apparently, for deliberation; the writer never saw him hesitate in choosing a site nor abandon one that had been chosen.

Making himself the center of his activity, he would pull the branches and twigs toward him from all directions, grasping and shoving them into place with his feet, and sitting upon the growing mat as he worked. When it was finished he would lie back for a few minutes to enjoy the fruits of his labor.

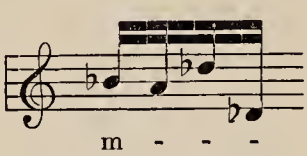
Chim's nests varied in size, sometimes measuring two feet

across. He was usually silent when making them, the following being the only utterance taken during nest building. Two isolated tones:



254

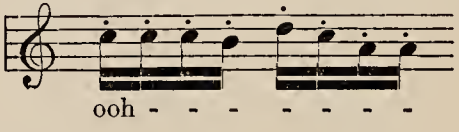
A rapid phrase:



255

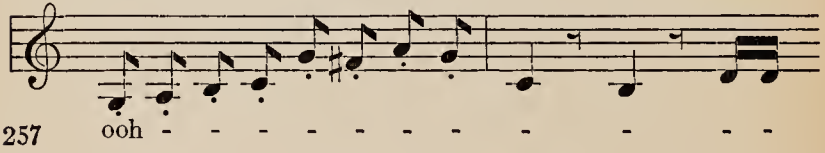
Panzee showed no inclination to make nests; once or twice however she manifested some interest in Chim's activity.

They had been at the sand-hole for some time when Chim went to a group of birch trees, a little distance away, and made a nest. When it was finished he swung down, and went back to tease Panzee. She remonstrated:



256

Then drawing him to her, she began to look through his fur as though making an affectionate appeal to him to be kind:

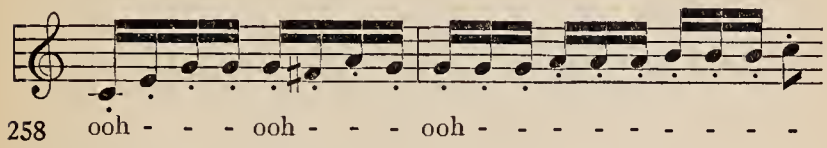


257

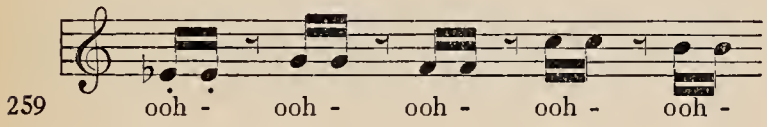
Chim ran back to the tree, and climbing higher, made a large nest, about two feet wide. Then dropping down he filled his

mouth with sand, and climbing back to the nest that he had just finished, he lolled there chewing the sand. This performance he repeated twice.

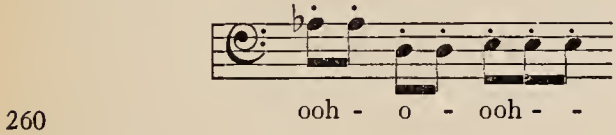
Panzee, in the meantime, climbed part way up the tree that grew next to that in which Chim was busy. He went still higher, and built a third nest. Then mounting to the top of the tree, he swung down in glee to Panzee, who watched him apprehensively, saying:



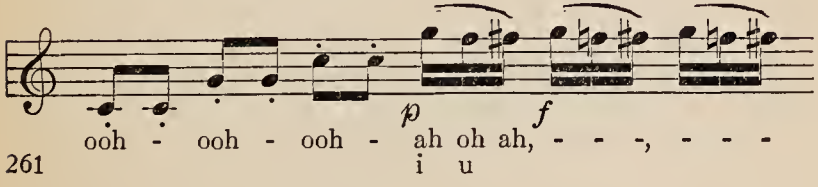
And, as he approached her from below:



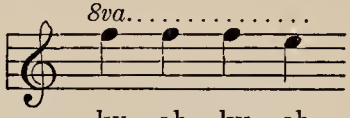
Then meditatively:



As he jostled her roughly:



Then he caught her foot and hung with his full weight upon it. This was evidently very painful:

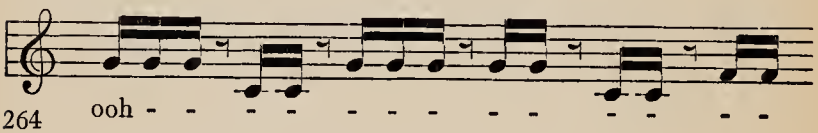


262

The teasing continued intermittently with various expressions of Panzee's emotions. With deliberate remonstrance:

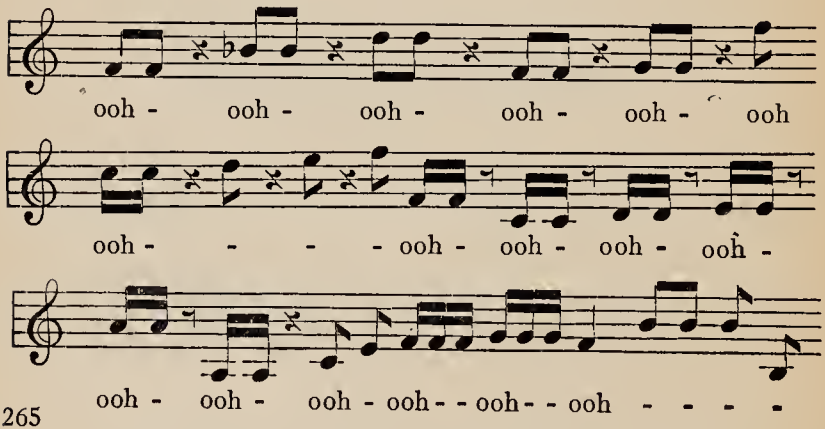
263

Growing anxious as her perch became insecure under Chim's treatment:



264

Frightened—a rapid pronouncement:



265

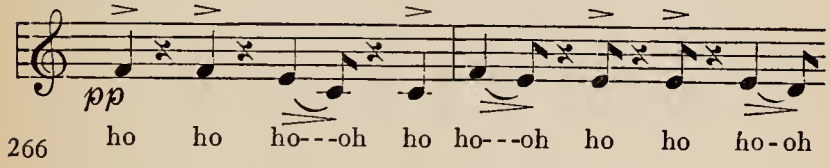
Warnings

While Chim showed a clearly marked instinct of protection toward Panzee, in times of danger, it was she who gave what seemed to be a note of warning when any strange creature, such as a squirrel, a horse, or even an automobile came within her vision.

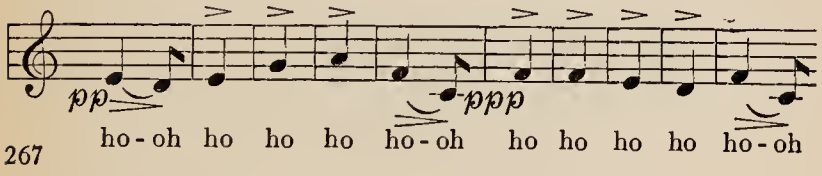
Under such circumstances, she uttered a characteristic musical phrase of two tones with the word *ho* in a peculiarly suggestive manner. The first tone, though soft, was clear and slightly accented, then immediately suppressed, the second tone being barely audible. This gave it a mysterious quality that was very distinctive. She also used the first tone alone.

Below are a few examples.

A red squirrel began to chatter in an apple-tree a few rods from the observation room where Panzee sat. She became alert at once, and uttered very slowly:



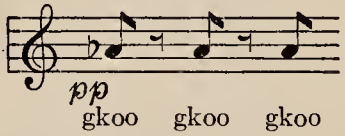
Chim climbed up on the screen, and watched intently as she continued:



When the grocer's delivery truck stood chugging near the house, in the distance:

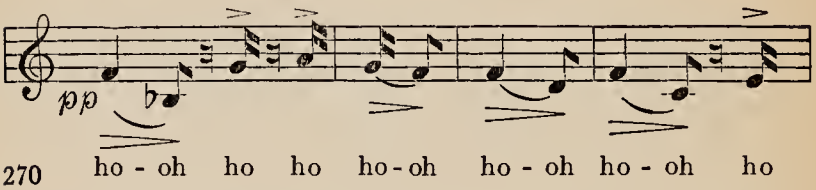
268

Chim was silent meanwhile until Miss M. came to the outside of the screen, when he went to her and, looking toward the automobile, said:



269

A pair of red squirrels came to the apple tree on another day with this result from Panzee:



270

They became very noisy, and her voice rose in pitch and increased in volume:

271

A horse with its rider entered the yard some distance away. She became very alert:

272 ho - oh

As they came nearer, she retreated to hide behind one of her human friends; from this position, however, she watched the approach of the horse intently:

273 ho - oh ho

And when it came close to the screen uttered more animatedly:

274 ho-ho - oh ho - oh ho - oh ho - oh

Dr. Y.'s automobile stood by the house with the motor running, and she sounded her notes of alarm thus—dragging the intermediate tones in a genuine portamento:

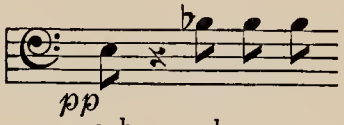
ho - oh ho - oh ho - oh ho - oh ho - oh ho - oh ho - oh

275

Fear

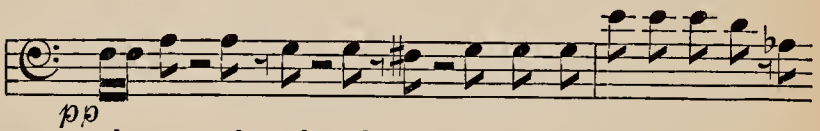
Both chimpanzees were influenced more or less by apprehension when in the open. This was shown, particularly in Panzee's case, by their unwillingness to go more than a short distance from human protection. The feeling in greater or less degree was revealed by various incidents, some of which brought out conspicuously Chim's care of Panzee.

On the way to the pasture, Panzee once stopped at the brow of the hill, and looking around apprehensively, uttered this phrase:



276 ooh ooh - -

Chim, who was a little way ahead, turned back instantly. He put his arms around her protectingly, and looked about as though he too were afraid. In this position they walked slowly on, she continuing to utter her fears and he on guard for danger:

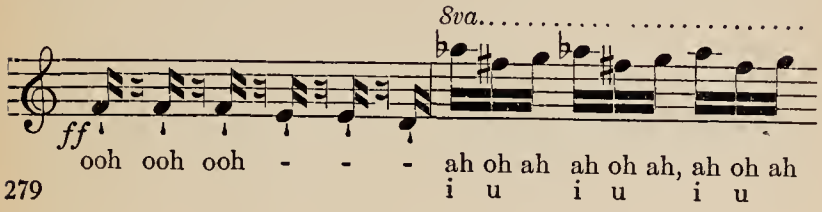


277 ooh - - ooh ooh ooh ooh ooh ooh ooh ooh - - - -

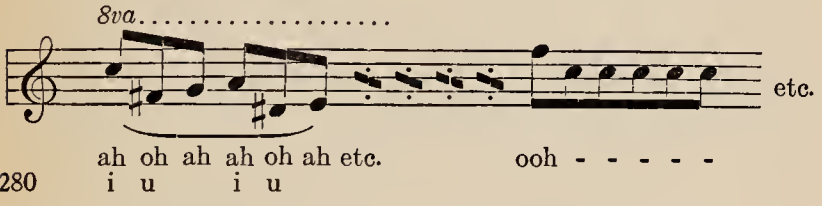
A strong wind which made an unusual sound in the grass, bushes, and trees seemed to be the cause of their anxiety. Returning after several hours she begged to be carried:

278 ooh ooh ooh ooh ooh ooh ooh

She was evidently still afraid, finally shrieking until she was taken up:



On another day in the open there was a large party of guests, during whose stay Chim had received much adulation from the younger people. He was loath to leave when it came time for him and Panzee to go indoors. He avoided the issue, at first, by climbing a large tree nearly to the top where he built a nest, and where he seemed inclined to stay. Miss M. took Panzee and started off without him, in the hope that he would follow. After they had gone some distance Panzee looked around, and finding that Chim was not with her, went back after him. She had gone about half the distance when she seemed to realize that she was alone, and began to scream:



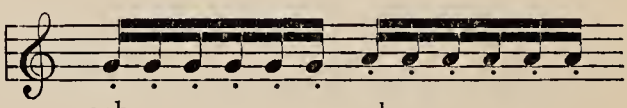
When Chim heard this he ran up, and putting his arms around her, helped her along as gently as possible toward Miss M., thus atoning with his tenderness for his many sins of rough treatment in his play.

Chim was playing one day on a high fence, the top rail of which was loose at one end, furnishing a fine teeter for one of his ingenuity. Before him there stretched two fields, separated by a stone wall, in which was an opening used occasionally by cows that grazed some distance away, usually out of sight. To test his behavior, D. drove a cow toward this gap which was but a few feet away. Chim discovered her as she was about to pass through. Standing quiet for a moment, he watched her intently, and retreated a step or two. Then seeming to regain his courage, he recovered his original position, and as the cow came on, stamped hard and fast with his feet on the second rail while he slapped the loose top one as hard as he could with his hands. (See no. 302.) The cow was fascinated for a moment, but soon turned and hurried away, leaving the field to Chim—an amusing spectacle, in the bravado of his diminutive figure.

On another occasion, a large horse with its rider suddenly galloped over the brow of the hill to where the chimpanzees were being held for a photograph.

Chim, in a panic, jumped to the ground, and ran away. Although the horse had gone when he was brought back, he kept looking anxiously about, and finally made off again, going some distance to a person whom he knew.

Panzee on the contrary, seemed to feel safe in being held during this episode. On being put down, she voiced her protest anxiously:



281

And later, while passing the place where the horse had been, she was uneasy:

The causes of fear or apprehension in the chimpanzees were various, and sometimes difficult to understand. Thus Panzee stood in dread of a large burlap bag filled with hay, which she was obliged to pass frequently. She would meet the situation bravely, however, holding her head high, stamping her feet, and raising her fur, as she passed with an air of injured dignity.

Both animals were fearful of noises when their cause was obscure, and at such times were silent.

At the chatter of squirrels that were hidden from view, Panzee would run to someone for protection or seek her nest, but when they could be seen—see nos. 266, 267, and 270—both chimpanzees became keenly alert, and Panzee would call her warning.

The clatter of boards and farm tools in the next room was inexplicable. Chim would protect Panzee with his arms, and both would stand huddled together for some time after the noise ceased.

CHAPTER IV

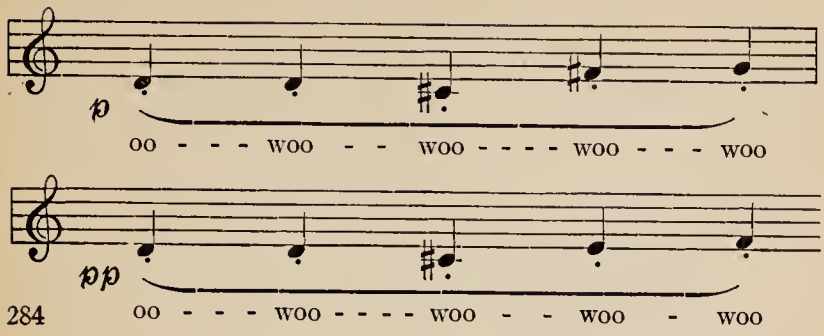
Observations of Adults at the New York Zoölogical Park

The interesting records secured from Chim and Panzee at once suggested comparison with others of the species, to determine what similarities might exist. No extensive observations have as yet been made for this purpose; but the writer is indebted to Dr. William T. Hornaday, Director of the New York Zoölogical Park, for the opportunity of studying briefly, though under excellent conditions, the three fine adult chimpanzees in that collection.[1]

Boma, a splendid male specimen in this group, was highly articulate, while Suzette was silent for the most part, and Fanny chiefly tonal in her utterance. Boma's regular food was oranges, apples, and bananas, and he usually began calling for it about an hour before feeding time, which varied somewhat. He would move about restlessly or sit with his eyes fastened on the passage-way through which his keeper was expected, and would utter certain preliminary phrases as softly as his full baritone voice allowed. Some of these were as follows:

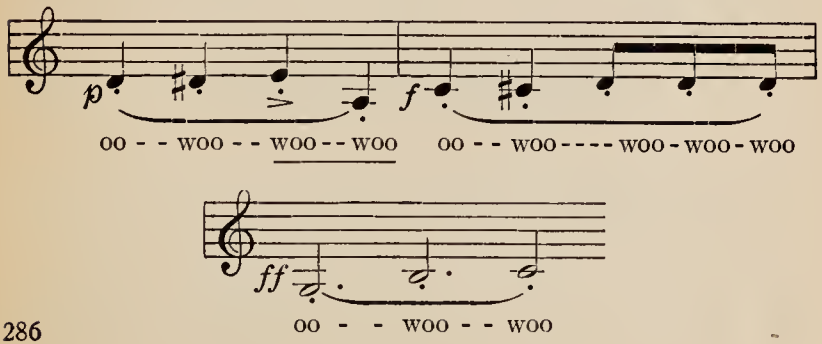
283

[1] Acknowledgment is also due to Mr. Palmer, Keeper of the Primate House for much kindly assistance.



There was a non-legato, bounding effect in the production of these tones indicating a large reserve of vocal power. The following phrases suggested the rumblings of distant thunder:

There appeared, as underscored in the latter part of the first measure below, the downward-moving interval that will presently be seen to be most characteristic of his call:

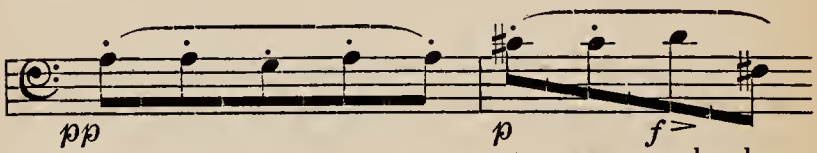


This is an exact counterpart of Chim's fruit motive (see nos. 74, 91, 113, 122, and 145). Chim hummed or whined the motive, but Boma used the expression *wáh-hoo*, which occurred more and more frequently as the time for his food drew nearer:

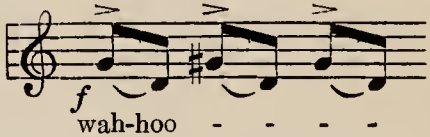
287

287a

287b

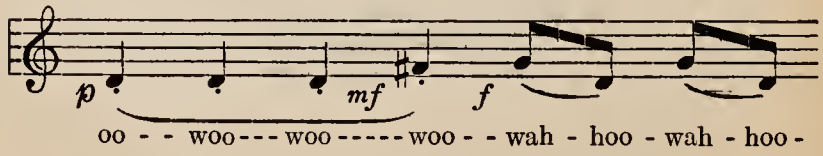


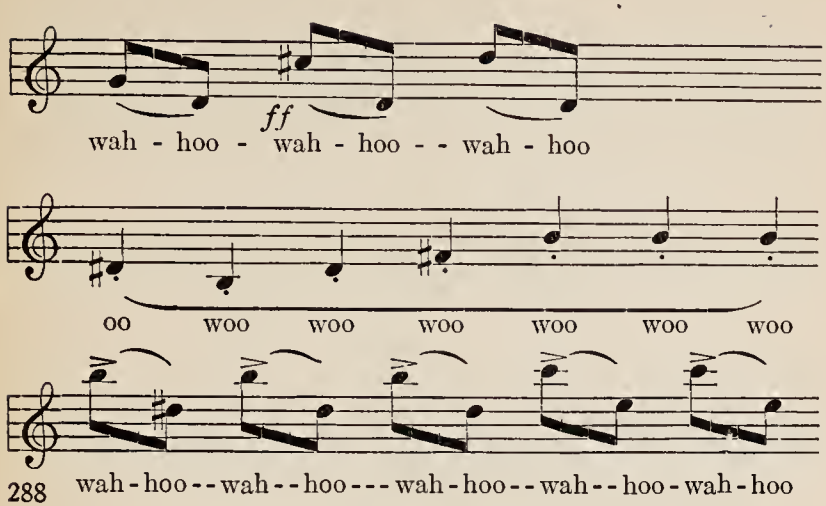
287c



287d

Also the following, which gradually rose in pitch, as the storm of his reiterated demands gathered:





Sometimes the *wâh-hoo* broadened into long emphatic tones, but the phrase always retained the character of the fruit motive:

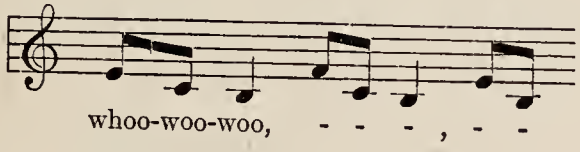
His complete call, beginning, as has been seen, with the soft deep-toned phrases, *oo-woo-woo*, continued with *wah-hoos* that increased in animation and tempo until he reached his climax—a prolonged yell of shrill, deafening quality difficult to describe:

f
oo - - woo - woo - woo - wah - hoo wah - hoo
ff
sfz
wah - hoo wah - hoo (yell)
f
oo - - - - woo - - - wah - hoo - wah - - hoo - wah - - hoo - -
8va.
ff
sfz
290 wah - - hoo - wah - - hoo - wah - hoo (yell)
f
sfz
sfz
291 oo - - - woo - - - woo - - - woo - - - woo (yell) (yell)

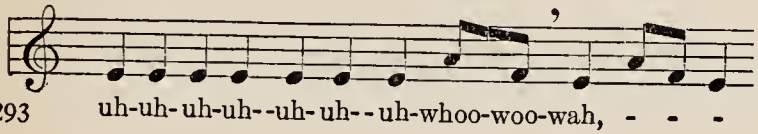
While yelling he would frequently jump to the floor, run about, and stamp a violent rhythmic accompaniment; then, resting his weight on his hands, would beat a clanging tattoo

with his feet thrown up against an iron door in the wall of his cage.

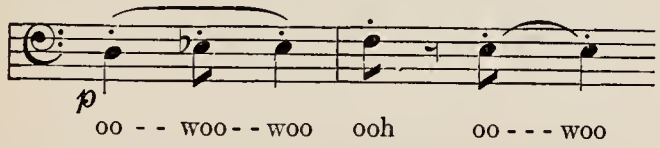
Fanny sometimes joined in the call for food with *whoo-woo-woo:*



And a hoarse bark on a single tone, followed by *whoo-woo-wah:*



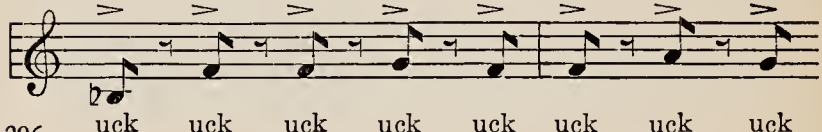
Suzette uttered occasional tones of approval to Boma's calls, but was usually silent, although very active in her cage.



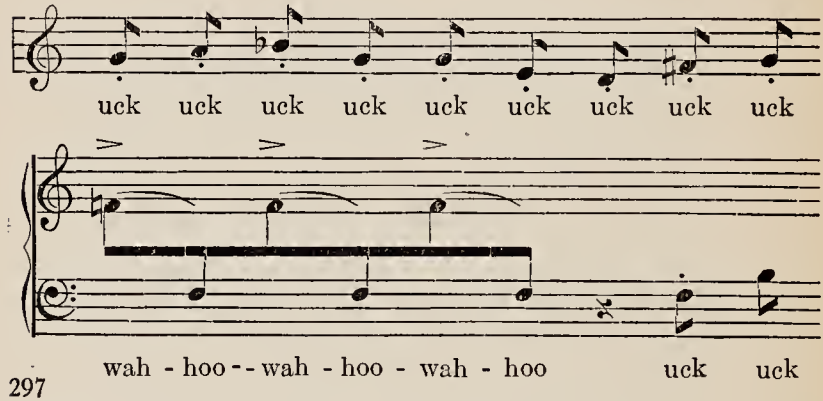
After several days of observation with no indication that Boma made use of a food-word comparable to that which Chim and Panzee used—*gahk,* or one of its variants—permission was asked to feed the chimpanzees, in the hope of gaining some response by speaking the word while offering food. A large juicy apple was given him and *gahk* repeated several times. He responded with a broad smile of appreciation, and retired to his high perch to eat it. Then he was asked if he liked it, this time responding with *gah, gah, ah,*

ah, gah, gah! (See nos. 9, 97, 70, 138, and 155 for comparison.)

And later, before he had finished the apple, the keeper came and talked to him, and he answered with:

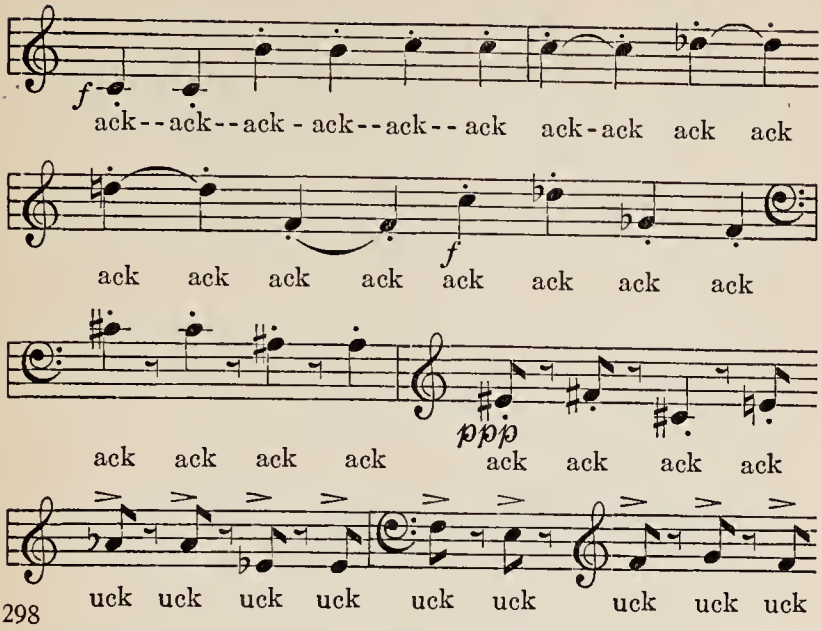


On another day, when the weekly treat of rice with raisins was given him, he responded:



Compare *wah-hoo* with the tones of the fruit motive, and nos. 145, 89, 91.

On later occasions he made frequent use of *ack* (*ahk*); thus:

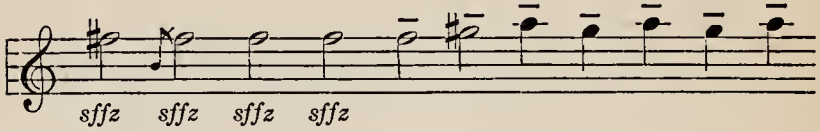

f
ack--ack--ack-ack--ack--ack ack-ack ack ack
f
ack ack ack ack ack ack ack ack
ppp
ack ack ack ack ack ack ack ack
298
uck uck uck uck uck uck uck uck uck

Ack seems to be the same word as *uck*, pronounced with the mouth in a more open position. Both of these expressions, as well as *gah*, appear to be variant forms of *gahk*, the food-word.

Boma had an intense dislike of having any other creature appear on the grass plot or the walk in front of the windows opposite his cage. In order to test him for a possible fear reaction, the keeper arranged for a pony with a light conspicuous mane to be led by the windows, the full length of the primate house. He started at the end farthest from the chimpanzees, and passed, one after another, the various monkeys, the baboons, the gibbon, and the orang utans. The first note of alarm from the monkeys aroused Boma. He climbed high on the front bars of his cage, and strained to see what was troubling them, uttering at the same time a threatening *wah-hoo*.

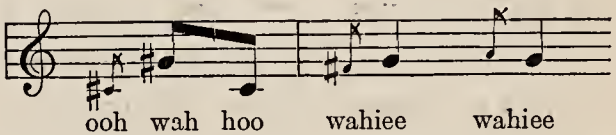
299 wah - - - - - - hoo wah - - - - - hoo - - - -

Then when the pony appeared before his windows, he screamed in prolonged tones of very disagreeable quality as follows:



300 wahiee wahiee - - - - - - - - - -

He continued this behavior until the pony was removed, and fifteen minutes later he was still calling intermittently:



301 ooh wah hoo wahiee wahiee

Throughout this episode, the dominant feeling that possessed Boma seemed to be rage rather than fear.

Another experiment was made with a toy gun, about two-thirds the size of a real weapon. Keeper P. crouched and pointed the gun, at which Boma's fur rose, and he retreated as far as possible—but constantly facing the gun. He then began to thump the floor with his knuckles, the wrists held stiff, and his body moving up and down with each thump. As he became more excited he stamped rapidly:

302

Then seeming to feel that noise was his best fighting asset (see paragraph after no. 280), he added to it considerably by knocking a tin pan that was left in his cage from supper the night before, against the iron wall. He kept up the din by hitting the pan first with one fist, then with the other, continuing this performance as long as the danger threatened.

Others of his stamping rhythms that he used when demanding food:

303

CHAPTER V

Lists of Words or Elements of Speech

Words beginning with gutturals

With *G*

1. *Gak*, Chim—food-word spoken rapidly, Nos. 114–127.
2. *Gahk*, Chim—food-word with vowel somewhat prolonged, Nos. 9, 33.
3. *Gah*, Panzee—food-word, No. 70.
4. *Gha*, Chim—spoken under stress during experiment, No. 54.
5. *Ghak*, Chim—under excitement, Nos. 115, 116, also when under great emotional stress—seemed to try to talk, Nos. 128, 129.
6. *Gho*, Panzee—rapidly repeated in greeting friends, Nos. 216, 217.
7. *Ghoo*, Chim—excited comment to a friend about a chugging motor.
8. *Ga-ha*, Chim—to mechanic with blackened clothing and face, No. 169.

With *K*, whispered

9. *Kah-kah*, Chim—unhappy, penitent, No. 33.
10. *Ko-ko*, Panzee—emphatic whisper under excitement and,
11. *Ku-ku*, the same situation, No. 156.

With *K*, vocalized

12. *Ka-ka*, Panzee—sharp bark in fight with Chim, No. 253.

13. *Ky-ah*, Panzee—cry of distress, Chim hurting her, No. 262.
14. *Kuoh*, Panzee—very hungry, supper approaching, No. 67.
15. *Kah-hah*, *kah-ha-ha*, Chim—laughter, Nos. 185, 186, 289, and,
16. *Kuh-huh*, the same, 187–188.
17. *Kha* (*khah*), Panzee—variant of food-word, Nos. 155, 159.

Beginning with *aspirate*

18. *Ho-oh*, Panzee—alarm, uttered with prolonged vowel in first syllable, voice dropping very low in the second, Nos. 266–275.
19. *Ho-wha*, Panzee—sobbing and talking, No. 73.
20. *Whah*, Chim and Panzee—enthusiastic greeting under stress, Nos. 12, 58, 214.
21. *Who-ah*, Chim—loud, energetic utterance when hungry and food is brought, No. 23.
22. *Hŭh*, Panzee—very soft utterance, going to her nest, No. 222.

Beginning with *nasals and labials*

23. *Ngak*, Chim—intensive variant of the food-word *gak*—No. 1 in this list—Nos. 81, 82, 85, 89, 117, 121, 138, 140, 141, 146, 148, 150.
24. *Nghak*, Chim—intensive variant of *ghak*—No. 5 in this list—Nos. 51, 93.
25. *Nkak*, Chim—variant of the food-word; he was irritable, Nos. 112, 113.
26. *M*, Chim and Panzee—sound emitted with lips closed, often significant, many instances of fruit motive, etc.

27. *Vts*, Chim—unique sound, while looking through Panzee's fur, page 122.

Beginning with *vowels*

28. *Ah-oh-ah*, Panzee—half scream, apprehension, Nos. 191, 197, 208, 212, 279, 280.
29. *Ai*, (*ie*) Panzee—cry of pain, Chim biting her, No. 248.
30. *Ae*, Chim—double-toned scream, joy or anger, Nos. 1–4, 30, 35, 39, etc.
31. *Ooh*, Chim—pleading, Nos. 11, 56. Panzee—many uses, greeting, approval, protest, etc., Nos. 60–62, 152, 153, 157, 160, 191–198, etc.
32. *Ue*, Panzee—cry of pain, Chim pulling and twisting her fur, No. 226.

LIST OF REFERENCES

(1) Akeley, Carl E.: In brightest Africa. New York, 1923.

(2) Bradley, Mary Hastings: On the gorilla trail. New York, 1922.

(3) Cunningham, Alyse: A gorilla's life in captivity. Zool. Soc. Bull., 1921, 24, 118–124.

(4) Garner, R. L.: Apes and Monkeys: Their Life and Language. Boston, 1900.

(5) Hamilton, G. V.: Study of perseverance reactions in primates and rodents. Behavior Monographs, 1916, 3, no. 2.

(6) Hamilton, G. V.: A study of sexual tendencies in monkeys and baboons. Jour. Animal Behavior, 1914, 4, 29; 318.

(7) Hornaday, William T.: The Minds and Manners of Wild Animals. New York, 1922.

(8) Hrdlička, Aleš: Antropometry. Wistar Institute, Philadelphia, 1920, pp. vi + 163.

(9) Koehler, Wolfgang: Intelligenzprüfungen an Menschenaffen. Springer, Berlin, 1921, S. 194.

For publication of results from Canary Island Station see Abh. d. könig. Preuss. Akad. d. Wissensch., 1915–1918.

(10) Montané, Louis: A Cuban chimpanzee. (English translation by Rossy, C. S.) Jour. Animal Behavior, 1916, 6, 330–333.

(11) Rothmann, Max: Ueber die Errechtung einer Station zur psychologischen und hirn-physiologischen Erforschung der Menschenaffen. Berliner klin. Wochenschr., 1912, 42, 1–13.

(12) Yerkes, Robert M.: The mental life of monkeys and apes: A study of ideational behavior. Behavior Monographs, 1916, 3, no. 1.

Sans Tache

Sans Tache

IN THE "elder days of art" each artist or craftsman enjoyed the privilege of independent creation. He carried through a process of manufacture from beginning to end. The scribe of the days before the printing press was such a craftsman. So was the printer in the days before the machine process. He stood or fell, as a craftsman, by the merit or demerit of his finished product.

Modern machine production has added much to the worker's productivity and to his material welfare; but it has deprived him of the old creative distinctiveness. His work is merged in the work of the team, and lost sight of as something representing him and his personality.

Many hands and minds contribute to the manufacture of a book, in this day of specialization. There are seven distinct major processes in the making of a book: The type must first be set; by the monotype method, there are two processes, the "keyboarding" of the MS and the casting of the type from the perforated paper rolls thus produced. Formulas and other intricate work must be hand-set; then the whole brought together ("composed") in its true order, made into pages and forms. The results must be checked by proof reading at each stage. Then comes the "make-ready" and press-run and finally the binding into volumes.

All of these processes, except that of binding into cloth or leather covers, are carried on under our roof.

The motto of The Williams & Wilkins Company is *Sans Tache*. Our ideal is to publish books *"without blemish"*—worthy books, worthily printed, with worthy typography—books to which we shall be proud to attach our imprint, made by craftsmen who are willing to accept open responsibility for their work, and who are entitled to credit for creditable performance.

The printing craftsman of today is quite as much a craftsman as his predecessor. There is quite as much discrimination between poor work and good. We are of the opinion that the individuality of the worker should not be wholly lost. The members of our staff who have contributed their skill of hand and brain to this volume are:

Composing Room: Ferdinand Schilling, William Koch, Theodore Nilson, George Behr, Roland Stultz, Ray Kauffman, Fred. Krantz, William Sanders, John Flanagan, Andrew Rassa, William Fite, Harry LaMotte, George Moss, Herbert Leitch, Henry Shea, Walter Phillips.

Keyboard: Minnie Foard, Harry Susemihl.

Casters: Kenneth Brown, Ernest Wann, Mahlon Robinson, Charles Aher, George Smith, Frank Malanosky, Martin Griffen, Henry Lee, Frederick Wall.

Proof Room: Sarah Katzin, Alice Reuter, Mary Reed, Ruth Treischman, Ethel Strasinger, Lucille Bull, Angeline Eifert, Audrey Tanner, Edna Clark, Lewis Forney, Dorothy Strasinger, Lillian Gilland, Arthur Baker, Geraldine Brown.

Press: Leo Ledlich, Robert Gallagher, August Hildebrand.

Folder: Lawrence Krug.

Cutter: John Murphy.

COMPARATIVE PSYCHOLOGY MONOGRAPHS

A series of important studies on the behavior of men and animals, in which the comparative viewpoint is emphasized.

Single Numbers Procurable at Prices Indicated Below.

VOLUME I

1. **Studies of the reliability of the problem box and the maze with human and animal subjects.** By WILLIAM T. HERON and WALTER S. HUNTER. Pp. 56, *$1.00 postpaid.*
2. **A behavioristic study of the activity of the rat.** By CURT P. RICHTER. Pp. 55, *$1.00 postpaid.*
3. **The distribution of practice in animal learning.** By CARL JOHN WARDEN. Pp. 64, *$1.25 postpaid.*
4. **Stuttering and allied disorders.** By LEWIS O. ANDERSON. Pp. 78, *$1.50 postpaid.*
5. **Comparative abilities of white and negro children.** By JOSEPH PETERSON. Pp. 141, *$2.25 postpaid.*

VOLUME II

6. **Relation between spontaneous activity and oestrous cycle in the white rat.** By G. H. WANG. Pp. 27, *$0.75 postpaid.*
7. **Relative effectiveness of certain incentives in animal learning.** By RIETTA SIMMONS. Pp. 79, *$1.50 postpaid.*
8. **Individual ability versus chance in the learning of the stylus maze.** By WILLIAM T. HERON. Pp. 60, *$1.00.*
9. **The suggestibility of normal and mentally defective children.** By IRENCE CASE SHERMAN. Pp. 34, *$0.75 postpaid.*
10. **On the relation of intelligence to achievement in the case of mentally retarded children.** By MAUD A. MERRILL. Pp. 100, *$1.50 postpaid.*
11. **A comparative study of retention curves for motor habits.** By CHIAO TSAI. *$0.75 postpaid.*
12. **The thyroid influence on the behavior of the white rat.**

Or the entire volume for $5.00.

THE WILLIAMS & WILKINS COMPANY

Publishers of Scientific Books and Periodicals

BALTIMORE, U. S. A.

Date Due

Nov 16 '33

OLIVER WENDELL HOLMES LIBRARY
PHILLIPS ACADEMY
ANDOVER, MASS.

PHILLIPS ACADEMY
3 1867 00009 1756